THE AMERICAN GAS LIGHT JOURNAL

REDMAN&KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXIV., No. 2. Whole No. 1,596. | NEW YORK, MONDAY, JANUARY 8, 1906. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF EDITOR, WRINKLE DEPARTMENT,
MILWAUKEE, WIS., Oct. 25, 1905.

To the Members of the Western Gas Association: The next meeting of the Western Gas Association will in all probability be the last one, owing to the proposed merging of the three leading gas associations. Therefore, every effort should be made to make it a rousing success in all respects, and it falls to my lot as Editor of the Wrinkle Department to again appeal to you for this department. I earnestly request those who have made promises of contributions to remember such as soon as possible, and I fully expect to hear from quite a number who have not made any promises, but who I know are in possession of something that would prove of value to the Wrinkle Department.

Yours very truly, B. MCADAM, Editor.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance,

Yours very truly. W. E. STEINWEDELL, Editor.

BRIEFLY TOLD.

OBITUARY NOTE, MR. JOHN LEETCH.—Following our mention last week of the death of Mr. John Leetch, General Manager of the Washington (D. C.) Gas Light Company, whose demise occurred at his home in Georgetown, D. C., the morning of December 22d, these lines are given. Deceased, who was a native of Ireland, came to the United States early in his career, settling in Baltimore, where his first commercial training was obtained. Later on, during the civil war, he was connected with the transportation department of the army, being stationed at Appomattox Court House, Va. When peace was declared he moved to Washington, eventually taking up his residence in Georgetown, where he soon became a potent factor in the business of that center. Becoming interested in the fortunes of the Georgetown Gas Light Company, he was eventually elected its President and served as such until 1893, in which year he was appointed General Manager of the Washington Gas Light Company, and served as such until his death. He was

SMITHSONIAN DEPT.

elected to membership in the American Gas Light Association at the 1894 meeting of that body, and of him it may be truthfully said that those who were under his direction respected and liked him. He was interested in certain railroad concerns, and naturally was prominent in the local affairs of Georgetown. He was an active member of the West Street Presbyterian Church. He is survived by his wife and seven children. The funeral services were held in the family residence the afternoon of December 24th, and interment was subsequently made in Glenwood Cemetery.

NOTES—

MR. W. F. HART has been elected General Manager of the Washington (D. C.) Gas Light Company vice the late Mr. John Leetch.

THE Western Gas Construction Company's last bulletin is numbered 221, and it deals with pipe fittings and specials. It is properly noted that the Company's "pipe fittings and specials were awarded a grand prize at the Louisiana Purchase Exposition, St. Louis, Mo., 1904;" and in the text of the bulletin it is said "Our flanges are made in accordance with the American Gas Light Association standard, unless otherwise ordered."

MR. A. T. JONES sailed for Rio Janeiro the 5th inst., per Lamport and Holt steamship "Byron." He goes in the interest of the Western Gas Construction Company, to oversee the construction of the water gas plant which that concern is to erect for the Rio Tramway, Light and Power Company.

MR. FRANK D. WHARTON has been appointed Superintendent of the Dauphin County (Pa.) Gas Company. He was formerly in the service of the Wilkes-Barre (Pa.) Gas and Electric Company.

THE Indianapolis (Ind.) Gas Company has presented to each of the first 700 consumers to pay their gas bills in the current month a package containing a pair of steel gas pliers and 6 Bray burners, as useful souvenirs of the season. The whole story is told in the half page advertisement of the W. M. Crane Company, as printed on page 61.

MR. W. B. ELLISON has been appointed Commissioner of Water, Gas and Electricity for New York, succeeding Mr. Oakley, resigned. Mr. William C. Cozier, of the New York *Sun*, has been appointed Deputy Commissioner, for the Borough of Brooklyn, on like account.

Progress in Electrical Work.

Mr. Thomas C. Martin, Editor of the *Electrical World*, in a recent interview with a reporter of a well-known New York newspaper, respecting the subject named in the heading, said:

Production of electrical apparatus in the United States reached during 1905 a total of about $200,000,000. This is allowing a rate of growth of about 10 per cent. The General Electric Company, one of the greatest manufacturers in the line, is said to have gained 40 per cent. in some departments over the preceding year. In fact, the demand for dynamos and motors has lately gone to enormous lengths. There is not a shop producing such apparatus that is not overtaxed and turning orders away if prompt delivery be a part of the contract. It would not be surprising to see the value of the dynamo and motor output reach from $65,000,000 to $75,000,000. It was about $55,000,000 in 1904. Since that time the great orders from underground roads and trunk steam roads have begun to flood the limited channels of electrical production, and it hardly seems possible that the revolution on the steam lines can go on very long or go very far without calling forth new sources of supply of apparatus beyond those already existing and in command of the field at very profitable prices.

This abandonment of the steam locomotive for electricity is indeed one of the great economic, technical and social facts of the year, for it touches everybody. It is good alike for the railroads and for every passenger who travels on them.

The third week of December alone saw the opening of the first electrical section of the West Shore; the announcement that, throwing out all steam locomotives, the Pennsylvania Railroad is to equip the Atlantic City-Philadelphia line complete with a fast electric service; the proclamation of the Erie Railroad that it will begin at once an elaborate system of electrification; the statement that the Grand Trunk Railroad has awarded an electric contract for its Sarnia Tunnel, scene of so many steam tragedies, and the opening of the Philadelphia subway system, similar to the underground in New York.

What inference from such a bunch of tidings can any shrewd, observing man draw except that on the steam roads the electrical revolution is well begun and swiftly spreading?

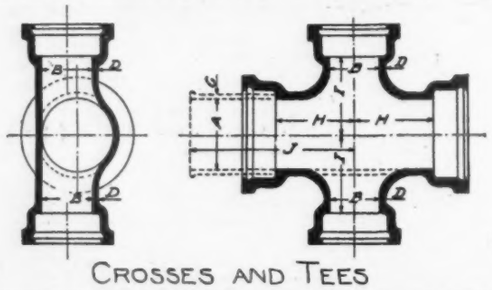
[ABSTRACT—Concluded from Page 11.]

PROCEEDINGS, THIRTY-THIRD ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE HOTEL PFISTER, MILWAUKEE, WIS., OCTOBER 18–20, 1905.

SECOND DAY—AFTERNOON SESSION.

REPORT OF THE RESEARCH COMMITTEE—*Continued from page 11.*



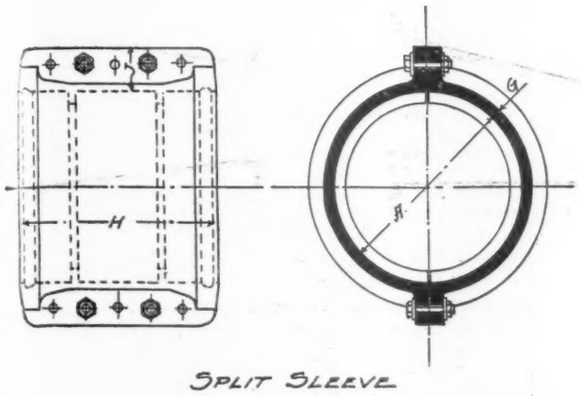
CROSSES AND TEES

	A	B	C	D	H	I	J	Weights — lbs. Crosses 4 Bell	Crosses 3 Bell	Tees 4 Bell	Tees 3 Bell
	4	4	40	40	8.00	8.00	20.0	123	119	93	90
	6	4	43	"	"	"	"	147	142	122	118
		6	"	43	"	"	"	167	163	131	127
	8	4	46	40	10.00	10.00	22.0	206	203	178	175
		6	"	43	"	"	"	227	224	189	186
		8	"	46	"	"	"	263	260	207	204
	10	4	49	40	12.00	11.00	24.0	309	313	278	283
		6	"	43	"	12.00	"	335	340	290	297
		8	"	46	"	"	"	369	375	309	316
		10	"	49	"	"	"	413	420	330	337
	12	4	54	40	14.0	13.0	26.0	366	552	528	524
		6	"	43	"	"	"	386	382	342	338
		8	"	46	"	"	"	422	418	380	376
		10	"	49	"	14.0	"	474	470	398	382
		12	"	54	"	"	"	510	506	404	400
	16	6	60	43	17.0	15.5	29.0	595	585	533	521
		8	"	46	"	"	"	635	621	574	560
		10	"	49	"	16.0	"	687	673	599	585
		12	"	54	"	17.0	"	725	709	617	603
		16	"	60	"	"	"	849	835	680	666
	20	6	67	43	19.0	16.0	31.0	839	811	795	767
		8	"	46	"	"	"	877	849	814	786
		10	"	49	"	17.0	"	927	899	855	811
		12	"	54	"	"	"	965	929	897	829
		16	"	60	"	19.0	"	1089	1081	970	952
		20	"	67	"	"	"	1225	1201	990	962
	24	8	76	46	21.0	18.0	33.0	1190	1174	1122	1108
		10	"	49	"	"	"	1230	1234	1152	1136
		12	"	54	"	20.0	"	1286	1270	1170	1154
		16	"	60	"	21.0	"	1412	1396	1233	1217
		20	"	67	"	"	"	1550	1534	1302	1286
		24	"	76	"	"	"	1678	1662	1366	1350
	30	10	88	49	13.0	23.0	27.0	1435	1424	1355	1326
		12	"	54	"	"	"	1489	1460	1373	1344
		16	"	60	19.0	24.0	29.0	1852	1718	1648	1574
		20	"	67	21.0	"	34.0	2090	2080	1807	1797
		24	"	76	23.0	"	36.0	2324	2320	1967	1963
		30	"	88	26.0	26.0	41.0	2756	2791	2250	2285
	36	12	99	54	15.0	25.0	27.0	1853	1868	1777	1752
		16	"	60	19.0	26.0	29.0	2270	2183	2016	1995
		20	"	67	21.0	27.0	34.0	2554	2599	2286	2291
		24	"	76	23.0	"	36.0	2840	2827	2488	2495
		30	"	88	26.0	"	41.0	3268	3335	2802	2869
		36	"	99	29.0	29.0	44.0	3762	3825	3125	3136
	42	16	110	60	19.0	30.0	29.0	2915	2765	2730	2580
		20	"	67	21.0	30.0	34.0	3265	3228	2882	2945
		24	"	76	23.0	"	36.0	3533	3521	3201	3189
		30	"	88	26.0	"	41.0	4071	4121	3575	3625
		36	"	99	29.0	"	44.0	4580	4625	3947	3990
		42	"	110	32.0	32.0	47.0	5320	5298	4435	4411
	48	16	126	60	19.0	33.0	29.0	3624	3464	3440	3280
		20	"	67	21.0	"	34.0	3950	3934	3722	3716
		24	"	76	23.0	"	36.0	4240	4237	3938	3945
		30	"	88	26.0	"	41.0	4793	4855	4377	4479
		36	"	99	29.0	"	44.0	5382	5484	4824	4926
		42	"	110	32.0	"	48.0	6109	6261	5340	5492
		48	"	126	35.0	35.0	50.0	6802	6895	5839	5936

Note:-Concentric outlets furnished when desired.

FLANGE STRAIGHT PIPE.

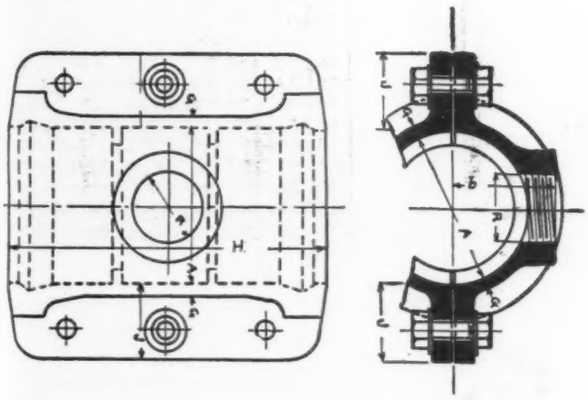
Nominal Diam	Outside Diam Flange	Diam Bolt Circle	No. of Bolts	Size of Bolts	Thickness Pipe	Weight per Foot	Weight per Length	Weight Single Flange	Weight of Bolts and Nuts Single Joint	Thickness Flange
4	9.0	7.125	4	.625	.40	19.2	230	8.53	1.9	.72
6	11.0	9.125	4	"	.43	30.4	364	11.60	1.9	.77
8	13.5	11.125	8	"	.46	41.8	501	16.54	4.1	.81
10	16.0	13.75	8	"	.49	55.2	662	19.54	4.1	.86
12	19.0	15.75	8	"	.54	72.1	865	35.38	4.7	.93
16	22.5	20.0	12	.750	.60	108.3	1300	43.0	10.6	1.00
20	27.0	24.5	16	"	.67	150.0	1800	57.5	14.2	"
24	31.0	28.5	16	"	.76	204.2	2450	71.3	15.2	1.125
30	37.5	35.0	20	.875	.88	291.7	3500	105.0	27.4	1.250
36	44.0	41.25	24	"	.99	391.7	4700	138.6	34.9	1.375
42	50.75	47.75	28	1.0	1.10	512.5	6150	169.5	56.0	1.56
48	57.0	54.0	32	1.0	1.26	666.7	8000	250.4	67.2	1.75



SPLIT SLEEVE

Size	A Inches	G Inches	H Inches	J Inches	Bolts No	Bolts Diam	Wgt. Lbs.
2	3.38	.38	8.0	2.75	4	.75	28
3	4.80	.38	12.0	2.75	6	.75	49
4	5.80	.40	12.0	2.75	6	.75	60
6	7.90	.43	12.0	2.75	6	.75	80
8	10.05	.46	15.0	3.00	8	.75	125
10	12.10	.49	15.0	3.00	8	.75	149
12	14.20	.54	15.0	3.00	8	.75	189
16	18.30	.60	18.0	3.75	10	.875	300
20	22.39	.67	18.0	3.75	10	.875	386
24	26.77	.76	18.0	3.75	10	.875	536
30	32.99	.88	18.0	3.75	10	.875	759
36	39.21	.99	18.0	4.50	10	1.00	976
42	45.45	1.10	18.0	4.50	10	1.00	1267
48	51.75	1.26	18.0	4.50	10	1.00	1769

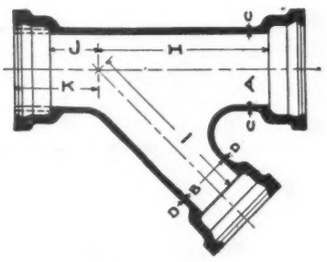
TO BE FURNISHED MACHINED, COMPLETE WITH BOLTS



SERVICE SLEEVE

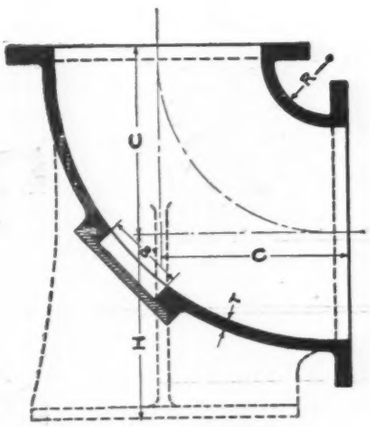
Size Inches	A Inches	b Inches	G Inches	H Inches	J Inches	R Inches	Wgts. Lbs.
2	3.38	2.35	.38	8	2.75	1.25	30
2	3.38	2.35	.38	8	2.75	1.50	30
3	4.80	3.40	.38	12	2.75	1.25	50
3	4.80	3.40	.38	12	2.75	1.50	50
4	5.80	3.85	.40	12	2.75	2.00	60
6	7.90	5.27	.43	12	2.75	3.00	85
8	10.05	6.37	.46	12	3.00	3.00	130

TO BE FURNISHED MACHINED
COMPLETE WITH BOLTS
"R" INDICATES SIZE OF PIPE FOR
WHICH THE HOLE IS TAPPED



Y'S.

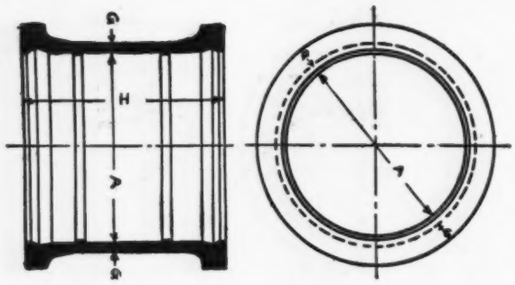
A Inches	B Inches	C Inches	D Inches	H Inches	I Inches	J Inches	K Inches	WGHTS- LBS Bell-all-Round	WGHTS- LBS Bell-and-Spigot
4	4	.40	.40	11.15	11.15	3.16	7.16	102	89
6	4	.43	.40	15.50	15.25	4.25	8.25	145	125
	6	.43	.43	15.50	15.50	4.25	8.25	167	147
8	4	.46	.40	19.30	15.80	5.31	9.31	207	179
	6	.46	.43	19.30	18.05	5.31	9.31	232	204
	8	.46	.46	19.30	19.30	5.31	9.31	254	226
10	4	.49	.40	22.75	22.00	6.75	10.75	276	233
	6	.49	.43	22.75	22.25	6.75	10.75	300	262
	8	.49	.46	22.75	22.50	6.75	10.75	322	284
	10	.49	.49	22.75	22.75	6.75	10.75	347	303
12	4	.54	.40	26.75	26.00	7.25	11.75	381	333
	6	.54	.43	26.75	26.25	7.25	11.75	406	353
	8	.54	.46	26.75	26.50	7.25	11.75	425	377
	10	.54	.49	26.75	26.75	7.25	11.75	436	408
	12	.54	.54	26.75	26.75	7.25	11.75	508	460
16	16	.60	.60	35.13	35.13	9.12	13.62	824	652
20	20	.67	.67	38.53	38.53	11.03	15.53	1227	1127
24	24	.76	.76	43.00	43.00	13.00	18.00	1681	1703
30	30	.88	.88	52.50	52.50	13.75	18.75	2087	2884
36	36	.99	.99	60.38	60.38	15.37	21.87	4389	4145
42	42	1.10	1.10	70.00	70.00	22.00	27.00	5718	5418
48	48	1.26	1.26	80.00	80.00	25.00	30.00	7988	7600



QUARTER BENDS

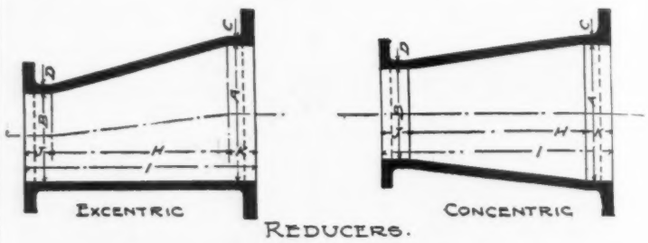
Nominal Dia.	C	T	R	H	Weight	
4	6.0	.40	2.0	7.0		40
6	6.0	.43	3.0	8.0		68
8	10.0	.46	3.0	9.25		108
10	11.0	.49	4.0	10.50		145
12	12.0	.54	4.0	11.0		215
16	14.0	.60	4.0	15.25	280	310
20	18.0	.67	5.0	16.76	458	540
24	20.0	.76	5.0	18.75	661	825
30	24.0	.88	5.0	22.0	1085	1320
36	29.0	.99	5.5	25.5	1703	2035
42	32.0	1.10	5.5	29.0	2371	2810
48	35.0	1.26	5.5	33.0	3365	3960

WITH BASE OR HAND HOLE



SOLID SLEEVE

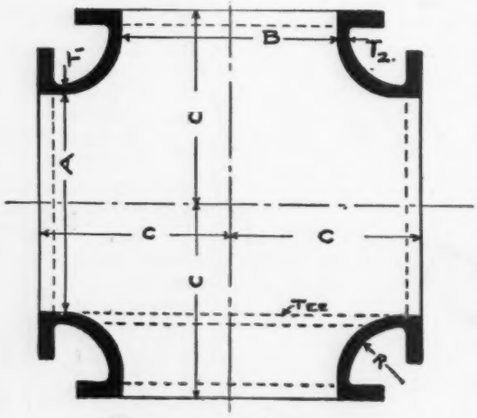
SIZE INCHES	A INCHES	G INCHES	H INCHES	WGTS. LBS.
2	3.38	.38	8	15
3	4.80	.38	12	30
4	5.80	.40	12	40
6	7.90	.43	12	58
8	10.05	.46	15	85
10	12.10	.49	15	114
12	14.20	.54	15	149
16	18.30	.60	18	239
20	22.59	.67	18	324
24	26.77	.76	18	471
30	32.99	.88	18	689
36	39.21	.99	18	896
42	45.45	1.10	18	1181
48	51.75	1.26	18	1683



REDUCERS.

A Inches	B Inches	C Inches	D Inches	H Inches	J Inches	K Inches	I Inches	Weight Lbs.
6	4	.43	40	7.0	2.5	2.5	12.0	38
8	4	.46	40	15.0	2.5	2.5	20.0	72
	6	"	.43	7.0	"	"	12.0	68
10	4	.49	.40	23.0	"	"	28.0	117
	6	"	.43	15.0	"	"	20.0	96
	8	"	.46	7.0	"	"	12.0	78
12	6	.54	.43	23.0	.30	"	28.5	160
	8	"	.46	15.0	"	"	20.5	143
	10	"	.49	7.0	"	"	12.5	125
16	8	.60	.46	32.0	"	"	37.5	269
	10	"	.49	24.0	"	"	29.5	250
	12	"	.54	15.0	2.5	"	20.0	219
20	10	.67	.49	40.0	3.0	"	45.5	447
	12	"	.54	32.0	2.5	"	37.0	398
	16	"	.60	16.0	"	"	21.0	304
24	16	.76	"	30.5	3.5	30	37.0	553
	20	"	.67	14.5	"	"	21.0	412
30	20	.88	"	39.0	"	"	45.5	727
	24	"	.76	24.0	3.0	"	30.0	745
36	24	.99	"	48.0	"	"	54.0	1436
	30	"	.88	24.0	"	"	30.0	1025
42	30	1.10	"	48.0	"	"	54.0	1919
	36	"	.99	24.0	"	"	30.0	1925
48	36	1.26	"	48.0	"	"	54.0	2562
	42	"	1.10	24.0	"	"	30.0	1760

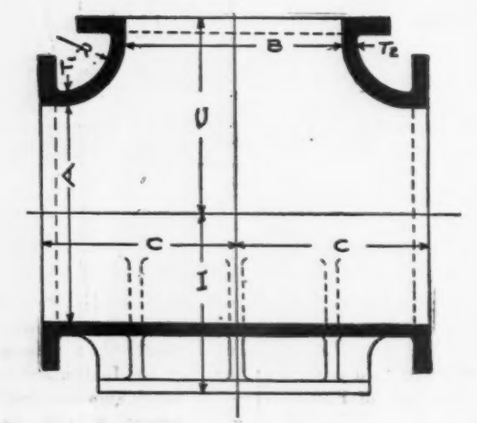
A	B	C	T_1	T_2	R	WEIGHT TEE	WEIGHT CROSS
4	4	6.0	.40	.40	2	45	55
6	4	8.0	.43	.40	3	73	83
6	6	8.0	.43	.43	3	77	91
8	6	10.0	.46	.43	3	116	136
8	8	10.0	.46	.46	3	123	151
10	6	11.0	.49	.43	4	154	173
10	8	11.0	.49	.46	4	161	188
10	10	11.0	.49	.49	4	178	200
12	8	12.0	.54	.46	4	231	258
12	10	12.0	.54	.49	4	237	264
12	12	12.0	.54	.54	4	257	309
16	10	14.0	.60	.49	4	349	376
16	12	14.0	.60	.54	4	366	421
16	16	14.0	60	.60	4	384	450
20	12	18.0	.67	.54	5	578	631
20	16	18.0	.67	.60	.5	594	667



TEES AND CROSSES

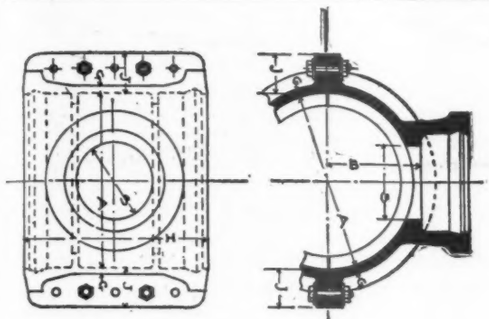
A	B	C	T_1	T_2	R	WEIGHT TEE	WEIGHT CROSS
20	20	18.0	.67	.67	5	639	731
24	16	20.0	.76	.60	.5	830	898
24	20	20.0	.76	.67	5	865	969
24	24	20.0	.76	.76	5	896	1029
30	20	24.0	.88	.67	5	1391	1508
30	24	24.0	.88	.76	5	1426	1578
30	30	24.0	.88	.88	5	1484	1694
36	24	29.0	.99	.76	5.5	2208	2469
36	30	29.0	.99	.88	5.5	2282	2517
36	36	29.0	.99	.99	5.5	2361	2674
42	30	32.0	1.10	.88	5.5	3055	3290
42	36	32.0	1.10	.99	5.5	3134	3448
42	42	32.0	1.10	1.10	5.5	3272	3624
48	36	35.0	1.26	.99	5.5	4364	4678
48	42	35.0	1.26	1.10	5.5	4457	4854
48	48	35.0	1.26	1.26	5.5	4604	5158

A	B	C	T_1	T_2	R	H	WEIGHT
4	4	6.0	.40	.40	2.0	7.0	57
6	"	8.0	.43	"	3.0	8.0	91
"	6	"	"	.43	"	"	85
8	"	10.0	.46	"	"	9.25	141
"	8	"	"	.46	"	"	148
10	6	11.0	.49	.43	4.0	10.50	186
"	8	"	"	.46	"	"	193
"	10	"	"	.49	"	"	210
12	8	12.0	.54	.46	"	11.0	271
"	10	"	"	.49	"	"	277
"	12	"	"	.54	"	"	297
16	10	14.0	.60	.49	"	13.25	439
"	12	"	"	.54	"	"	456
"	16	"	"	.60	"	"	474
20	12	18.0	.67	.54	5.0	16.75	698
"	16	"	"	.60	"	"	714



FOOT TEES

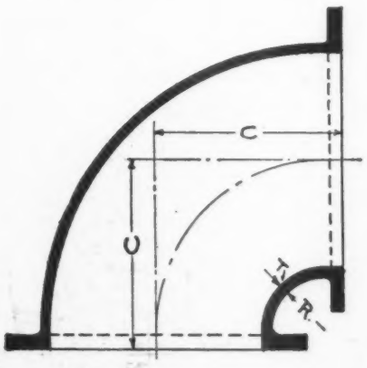
A	B	C	T_1	T_2	R	H	WEIGHT
20	20	18.0	.67	.67	5.0	16.75	759
24	16	20.0	.76	.60	"	18.75	1040
"	20	"	"	.67	"	"	1075
"	24	"	"	.76	"	"	1106
30	20	24.0	.88	.67	"	22.0	1671
"	24	"	"	.76	"	"	1706
"	30	"	"	.88	"	"	1794
36	24	29.0	.99	.76	5.5	25.5	2610
"	30	"	"	.88	"	"	2680
"	36	"	"	.99	"	"	2760
42	30	32.0	1.10	.88	"	29.0	3605
"	36	"	"	.99	"	"	3684
"	42	"	"	1.10	"	"	3772
48	36	35.0	1.26	.99	"	33.0	5064
"	42	"	"	1.10	"	"	5150
"	48	"	"	1.26	"	"	5305



HUB SLEEVE.

SIZE Inches	A Inches	B Inches	G Inches	H Inches	J. Inches	S Inches	WGTS Lbs.
10×4	12.10	6.55	49	15	3.00	4.00	163
10×8	12.10	6.55	49	18	3.00	6.00	195
12×4	14.20	7.64	54	15	3.00	4.00	200
12×6	14.20	7.64	54	18	3.00	6.00	256
16×6	18.30	9.80	60	18	3.75	6.00	325
16×8	18.30	9.80	60	18	3.75	8.00	338
20×6	22.39	11.97	67	18	3.75	6.00	410
20×8	22.39	11.97	67	18	3.75	8.00	418
20×10	22.89	11.97	67	18	3.75	10.00	459

TO BE FURNISHED MACHINED, COMPLETE WITH BOLTS.



QUARTER BENDS.

Nominal Dia. Inches	C Inches	T Inches	R Inches	Wgt. in lbs.
4	6.0	.40	2.0	32
6	8.0	.43	3.0	54
8	10.0	.46	"	87
10	11.0	.49	4.0	117
12	12.0	.54	"	180
16	14.0	.60	"	270
20	18.0	.67	5.0	440
24	20.0	.76	"	645
30	24.0	.88	"	1070
36	29.0	.99	5.5	1690
42	32.0	1.10	"	2360
48	35.0	1.26	"	3360

APPENDIX B

comprised the following:

Notes on Effect of Humidity on Pentane Lamp Standard and Correction Chart, which was presented by Mr. J. B. Klumpp, of Philadelphia:

The object of this paper is to present to the Association a means of comparing photometrical standards or other lights represented by open flame burners, such as the pentane lamp, candles, etc., with vacuum standards, or such lights as are not affected by varying conditions of the atmosphere.

This subject has been prominently brought before us on several occasions where commercial comparisons have necessitated the use of the electric standard against open flames, and the readings thus obtained were very conflicting, and needed some method for correction before it was possible to get results at all consistent. So the attached data and curves were constructed to meet this condition, and it is hoped they will assist those who have occasion to make such photometrical comparisons.

The effect of atmospheric conditions upon open flame standards has been studied by various authorities throughout the world for some years past, and their readings have been extended enough to give laws that have definitely determined the variation of the lighting strength of the Hefner and pentane lamps. From these readings, and confirmatory readings made by us, I have herewith prepared curves that may be used in connection with such comparisons, and the corrections made should fall within the limit of commercial accuracy for general photometrical purposes, of 2 per cent., which is the figure given by Dr. C. H. Sharp, in a paper read before the American Institute of Electrical Engineers in 1905.

The first authentic treatise that we have was in a paper presented before the German Society, in 1895, by Dr. Liebenthal, in Berlin, in which he gives the results of his readings on the Hefner and 1-candle power pentane lamp, showing the effect of moisture, barometric pressure, and presence of carbonic acid in the air on the light value of these lamps, the curves of which are appended, Fig. 1. This article is translated in the *Progressive Age* of December 2, 1895.

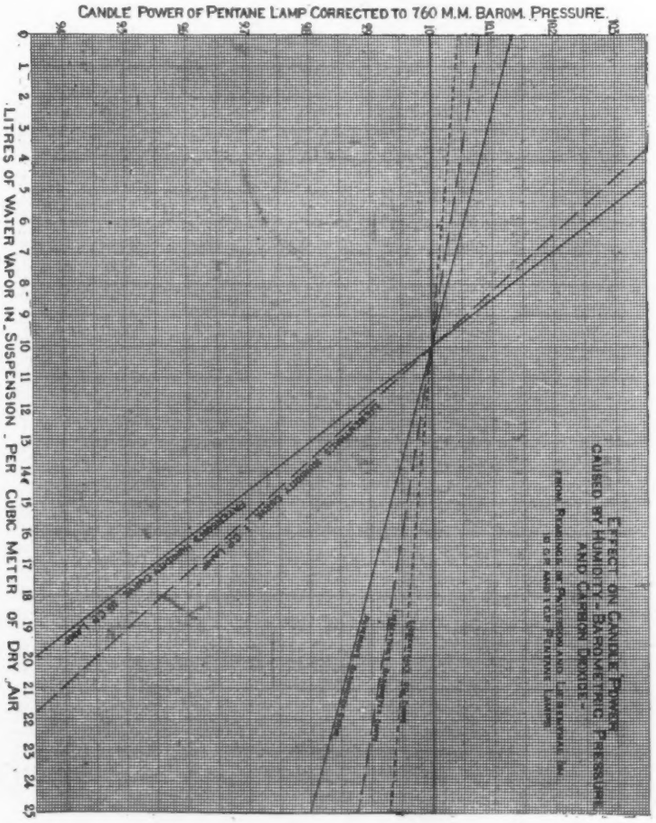

CANDLE POWER OF PENTANE LAMP CORRECTED TO 760 M.M. BAROM. PRESSURE.
LITRES OF WATER VAPOR IN SUSPENSION PER CUBIC METER OF DRY AIR
EFFECT ON CANDLE POWER CAUSED BY HUMIDITY—BAROMETRIC PRESSURE AND CARBON DIOXIDE.

Fig. 1.

Mr. C. C. Paterson, of the National Physical Laboratory, England, has conducted a set of experiments on the 10-candle power Harcourt pentane lamp, determining the variation for moisture and barometric pressure, the results of which he read before the British Association in 1904; published in the *Journal of Gas Lighting* of August 30, 1904. The constants for this lamp agree quite closely with the constants obtained by Dr. Liebenthal on the 1-candle power pentane lamp and he Hefner lamp, showing that the law has been closely defined by each.

This general subject was brought before the Association in 1900, at Denver, by Mr. Norris, in a paper presented through the Research Committee, and one of his recommendations at the time was: "That continued experiments which would give us correction factors that could be used to correct the average value of the lamp to some empirically chosen datum line of humidity, should be undertaken,"

but I doubt if any further work along this line has yet been done in this country.

The experiments conducted by Mr. Norris gave readings approximating those of Mr. Paterson, but the time was so limited for the presentation of his work that the number of readings made was hardly conclusive enough to establish a definite law of variation.

Mr. Paterson's readings were extended over several months and show remarkably close and careful work, and it is on the basis of his constants that the attached curves are constructed.

Fig. 1 shows both the Paterson and Liebenthal lines for depression in candle power per liter of moisture per cubic meter, which are the lines extending to the lower edge of the diagram. The barometric lines are shown justa bove, and the depressions marked by the extreme right end of the curves are for a variation of 25 mm. or about 1 inch of mercury. The carbonic acid determination was made by Liebenthal on the Hefner lamp, and is shown by the upper line, the entire depression shown by the extreme right end of this line is for 1 liter of carbonic acid above normal, or an excess of 10 parts in 10,000.

CURVES FOR THE DETERMINATION OF VARIATIONS IN CANDLE POWER OF THE OPEN FLAME PENTANE LAMP AS COMPARED WITH VACUUM ELECTRIC STANDARD, DUE TO HUMIDITY OF THE ATMOSPHERE.

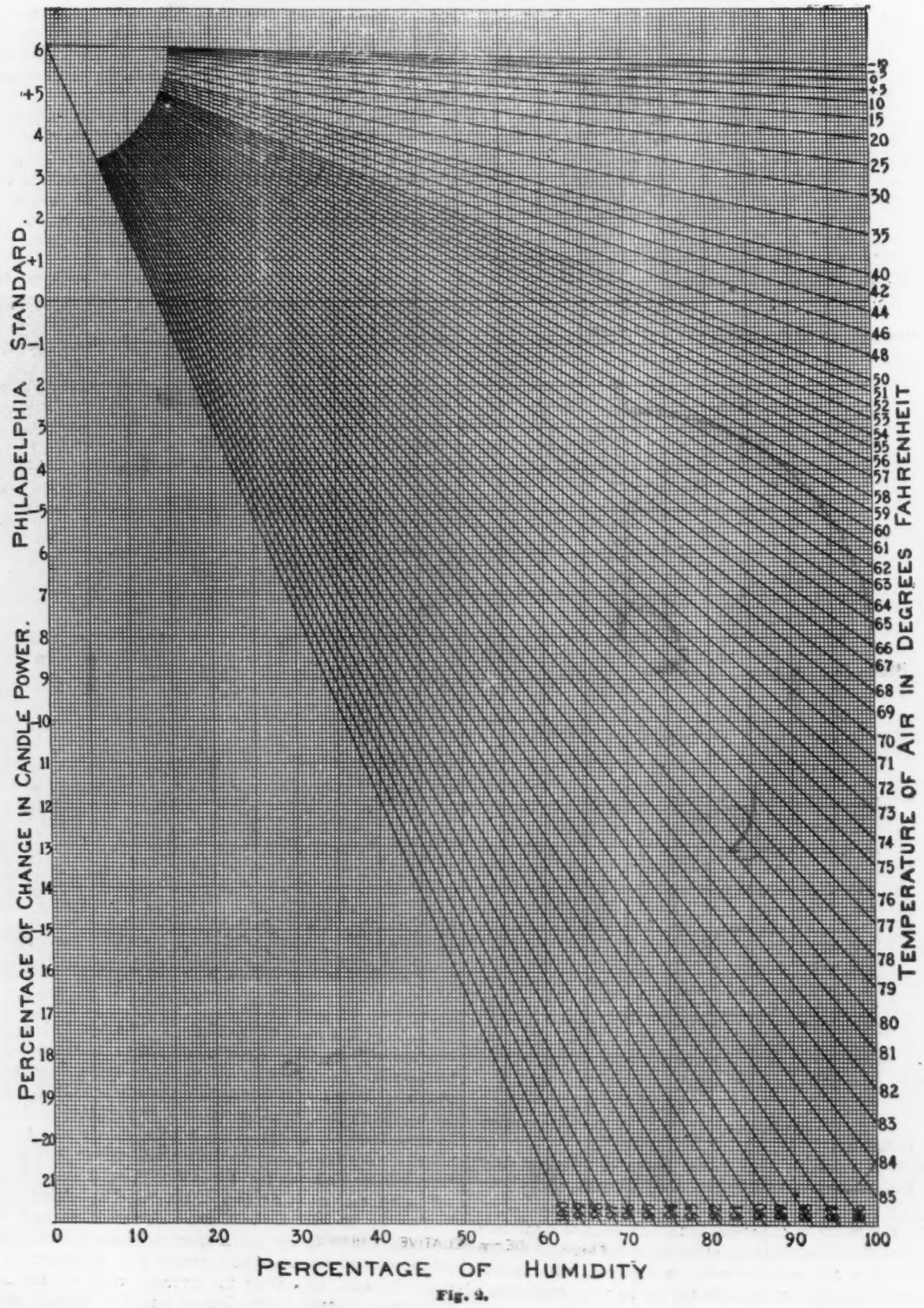


Fig. 2.

From the above observations, it seems that the light is affected by three conditions of the atmosphere, viz.: The amount of carbonic acid, the barometric pressure and the quantity of moisture in suspension.

a. The variation of the lamp for carbonic acid present is practically negligible, and for all intents and purposes may be omitted in the commercial readings. Dr. Liebenthal determined the variation of the Hefner lamp to be only .7 of 1 per cent. for each liter of carbonic acid present per cubic meter, or 1 part carbonic acid in 1,000 parts of air. According to Kent and other authorities, pure country air contains only 4 parts in 10,000, while the maximum amount allowable for good ventilation should not exceed 8 or 10 parts in 10,000, and the quantity in a well ventilated photometer room should not exceed 20 parts in 10,000; hence under ordinary conditions, the variation in lamp value should be less than .7 of 1 per cent., and seldom as high as 1.4 per cent. due to the presence of carbonic acid in the air; then with good ventilation, no correction for carbonic acid should be necessary.

b. The barometric pressure also affects the lamp. Dr. Liebenthal shows that 25 mm. or about an inch of mercury affects the Hefner lamp .28 per cent., the 1-candle power pentane lamp 1.2 per cent. The readings by Mr. Paterson, under a maximum variation of barometer from 739 mm. to 780 mm., or about 1.6 inches of mercury, each show a variation of lamp value of less than 1.6 per cent. from normal, so this deviation is not considered in the attached correction curves.

c. *Effect of Moisture.*—Accepting the Paterson curve as being correct, the effect of the moisture is shown to be considerable. A variation of 1 per cent. in candle power for each 1.515 liters of water vapor per cubic meter of dry air is obtained, and as actual conditions have been noted whereby the moisture varies from 4 to 40 liters per cubic meter of dry air, a correction of the value of the lamp is manifestly necessary, if comparisons are to be made with vacuum electric standards.

The correction curves shown by Fig. 2 are corrected to 30-inch barometric pressure, neglecting the presence of carbonic acid, on the basis of the 10-candle power Harcourt pentane lamp. As far as we have been able to determine, they will serve as a correction of the light of almost any open flame burner, and of uniform quality illuminating gases which assumingly vary in a value agreeing with this lamp. In other words, the pentane lamp, and a known value illuminating gas, will give apparently constant readings one against the other, independent of the state of the atmosphere.

The value of such a paper as this depends upon its adaptability to use in ordinary commercial practice, and from the above it is evident that the lamps must be corrected for humidity conditions.

How to Obtain the Humidity Conditions.—To obtain the percentage of humidity, it is advisable to use the wet and dry bulb thermometers, or some equally effective hygrometer, and determine the percentage of humidity from tables furnished by the government, which are shown in a compact way by the curves in Fig. 3. If this method is not used, the temperature and percentage of humidity are published daily, and sometimes hourly, in many cities by the United States Weather Bureau, and as this condition of the atmosphere is at the same time fairly constant throughout the city, these readings may be taken for the time being and applied to Fig. 2. With these two curves before the operator the quantity of moisture and the definite light giving value may be obtained.

On Fig. 3 the percentage of humidity is obtained by reading the temperature of the dry thermometer on the left hand vertical scale, then reading the difference in the wet and dry bulb thermometer, and find-

CURVES SHOWING PERCENTAGE RELATIVE HUMIDITY, FROM THE WET AND DRY BULB THERMOMETER READINGS.

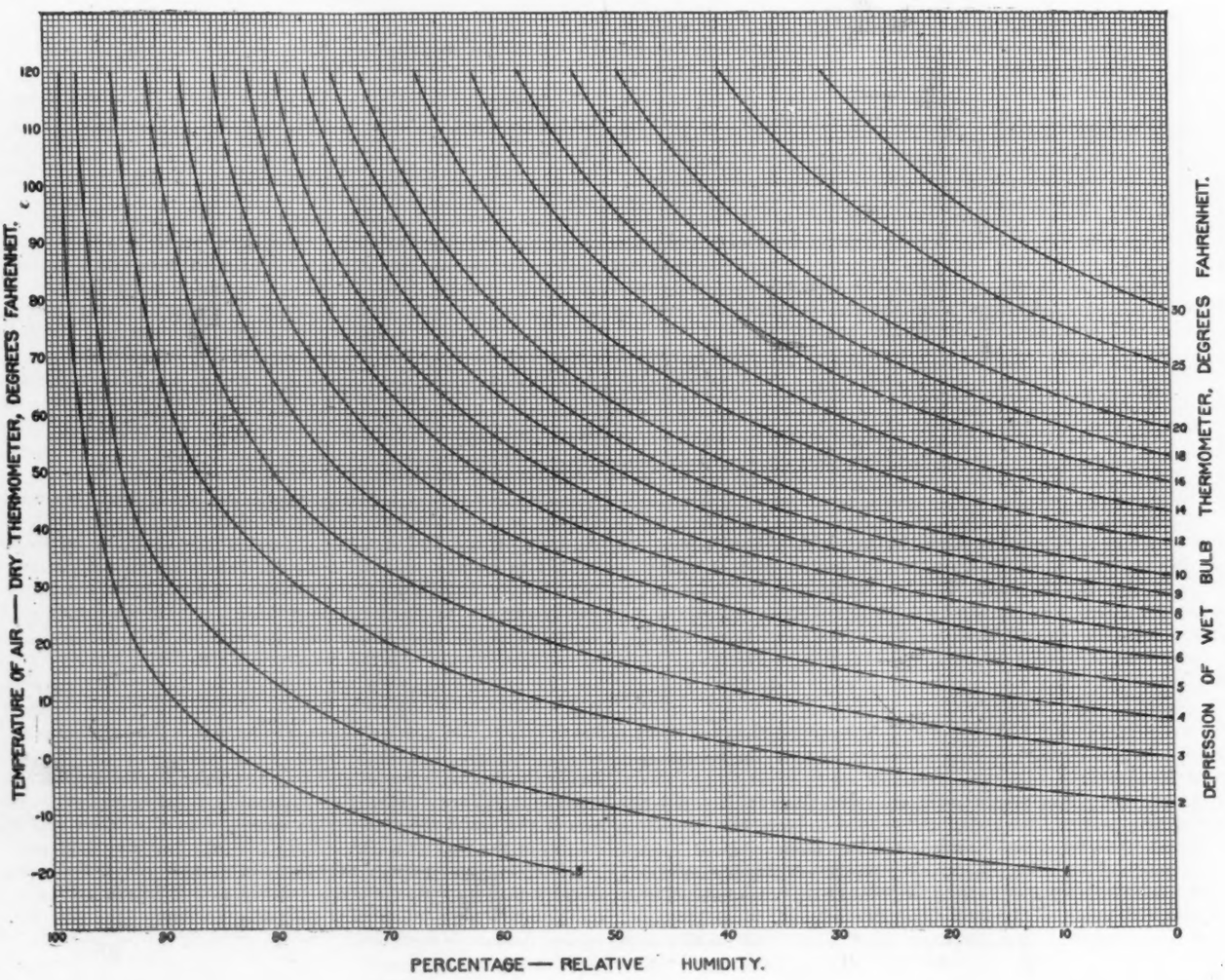


Fig. 3.

ing the curve of this difference. Where this curve intersects the temperature line, a vertical line dropped will determine the percentage of humidity at a barometer of 30 inches. Having the percentage of humidity and the temperature of the dry bulb thermometer, the variation of the lamp may be determined as follows: From Fig. 2 the radical lines show the dry temperature, the vertical lines show the percentage of humidity, and the horizontal lines projected to the left from this point of intersection will give the variation of the lamp value in per cent. For instance: With a temperature of 70° and a humidity of 60 per cent. the variation will be 3.3 per cent. In other words, the actual light giving value of the 10-candle power pentane lamp would be 3.3 per cent. lower than 10, or 9.67 candles.

To show the extent of this variation of humidity and the necessity of making these correction, I give herewith a table of the monthly average humidity conditions for Philadelphia for the past 34 years, and the effect this has on the candle power of the lamp:

	Dew Point in Degs. F.	Liters of Moisture Per Cubic Meter.	Variation in Pr. Ct. of Candle Power.
January	24.3	4.2	+ 3.4
February	24.4	4.2	+ 3 4
March	28.6	5,2	+ 2.7
April	37.9	7.6	+ 1.1
May	49.7	12.0	— 1.8
June	59.8	17.3	— 5.3
July	63.9	20.2	— 7.2
August	63.1	19.6	— 6.8
September	57.2	15.8	— 4.3
October	45.9	10.4	— .7
November	34.8	6.7	+ 1.7
December	26.6	4.6	+ 3.1
Yearly average	43.0	9.3	0.

This will show that the lamp has a value above normal during the 6 cold and dry months of winter, and a value below normal for the 6 warm and humid months of summer.

Individual readings have been made in Philadelphia that have shown abnormally excessive conditions of humidity, and assuming that this law holds for these extremes, the lamp value will be affected as follows:

	Dew Point in Degs. F.	Liters of Moisture Per Cubic Meter.	Variations in Pr. Ct. of Candle Power.
Jan. 5, 1904	— 8	.9	+ 5.5
Aug. 7, 1900	+83	39.1	— 19.7

The average yearly humidity conditions vary for different geographical locations. In the table below the Philadelphia, Washington, New York and Chicago figures were obtained from at least 22 years' observations of the United States Weather Bureau, while the London figures represent several years' observations of the Meteorological Office and the Kew Observatory, London. And the Berlin figures are given by Dr. Liebenthal, as accepted by the German authorities:

	Dew Point Degs. F.	Liters of Moisture Per Cubic Meter.
London	—	10.0
Washington	44	9.7
Philadelphia	43	9.3
New York	42	8.9
Berlin	—	8.8
Chicago	39	8.0

The results in this paper are calculated on a basis of liters of moisture per cubic meter of dry air, which were the figures originally used by both Liebenthal and Paterson. This is a volumetric measurement and necessitated a correction for vapor tension before the ordinary humidity and dew point readings could be utilized. To my mind these readings would have been in better form if they had been expressed in grammes per cubic meter, which would have determined a definite amount of water vapor per unit of variation.

Since the comparison of the pentane lamp is made against the vacuum electric standard, it might be of interest here to note the reliability of this electric standard.

The electric lamps obtain their original values from the Hefner lamp, whose constants have been pretty well defined and corrected for humidity, barometric pressure and carbonic acid. These original electric lamps are used to calibrate the secondary and sub-secondary standards, hundreds of which are now in use and whose value can be readily reproduced with the proper instruments. For instance, Dr. C. H. Sharp, of the Electrical Testing Laboratory, New York, has made a comparison of 6 of his lamps with various laboratories, the results of which are here given in terms of his lamps:

	Lamp Value.
Electrical Testing Laboratory, New York	15.96
National Physical Laboratory, England	16.11
Physikalisch-Technische Reichsanstalt, Berlin	15.95
National Bureau Standards, Washington	15.92
Laboratoire Central des Electriciens, Paris	16.2

For those who are further interested in the subjects of photometrical standards and their methods of operation and comparison, I would refer to a very complete article presented before the Optical Convention in London, in 1905, by A. C. Jolley, and published in the *Journal of Gas Lighting*, June 27, 1905.

Committee on Award of Beal Medal.

The President appointed Messrs. Rollin Norris, C. J. R. Humphreys and C. H. Nettleton a committee to consider the award of the Beal medal for next year.

The President explained that one paper remained on the list, by Mr. B. F. Lyons, of St. Louis, Mo., on the subject of

MUNICIPAL OWNERSHIP.

Owing to its length perhaps it was better to take the paper as read and have it published in the proceedings, and so get what they could from it in that way, for the time of adjournment was well passed.

On motion of Mr. A. E. Forstall the paper was ordered published in the proceedings as printed, the understanding further being that any member who desired to discuss it later could contribute such discussion for printing in the Book of Proceedings.

[For the text of Mr. Lyons' paper, see Journal, Nov. 27, 1905, p. 878.]

Mr. E. G. Pratt, Chairman of the Committee on Entertainment, made an announcement, after which the meeting was declared adjourned.

A Gas Calorimeter.

[A commuication presented to the English Royal Society, by C. V. Boys, F.R.S.]

In the report of the Gas Section of the Electrical and Gas Exhibition held at the Crystal Palace in 1884, there is an illustrated account of a gas calorimeter devised by Mr. F. W. Hartley for the purpose of testing the calorific value of the gas used in the cooking and heating apparatus shown in the exhibition.

In this instrument the gas to be examined is passed through a delicate meter and governor, after which it is burned in a Bunsen burner in the instrument. The heat is taken from the products of combustion and the unchanged air by means of a stream of water, the rate of flow and rise of temperature of which are determined. From these observations, the calorific value of the gas can be deduced. Mr. Hartley considered the very small corrections due to the effluent gas being slightly different in temperature from the surrounding air; also corrections due to adventitious loss or gain of heat, and to the change in the specific heat of water with temperature. The paper unfortunately only occupies 5 pages, and the construction of the details of the instrument can only be inferred from the figure.

The Hartley type of apparatus has in the last 14 years become well known owing to the sale of the excellent instrument designed by Junkers. I have had occasion to use this instrument a good deal; and while I in no way criticize it on the ground of want of accuracy, I have found it unwieldy and inconvenient in use. If the water and gas supply and the water escape, as provided, suit the surroundings, well and good: if not, pipes must be taken round to adapt the surroundings to the instrument. The thermometers for the inlet and outlet water are at very different levels, and the instrument is inordinately high, so that if placed on a table or by the side of an ordinary sink, the observer has to keep climbing up and down in order to read the two thermometers and make notes. The thermometers and glasses provided are admirable. In this respect improvement appears impossible; but the readings easily made to $\frac{1}{10}$° C. are vitiated by the constant spasmodic jumps of the indication of the outlet thermometer in consequence of warmer and cooler streaks in the issuing water. These irregularities may amount to $\frac{1}{10}$° more or less; and though they are not enough to introduce error of consequence, they give the opportunity to different observers to read on the whole high or low, and they may encourage the idea that accuracy in reading the thermometer is not of much consequence. The water content of the instrument is 1,700 c.c.; and so, with a usual rate of flow, from 2 to 3 minutes are required to change the water. This

large content and the consequent time of change, must be taken into account if the temperature of the inlet water is undergoing a small but steady variation at a rate sufficient to be observed in this time. Simultaneous measures of inlet and outlet temperature would not give the true rise of temperature; to approximate to this the inlet readings should be taken 2 or 3 minutes before the corresponding outlet readings—the interval depending on the rate of flow. A more serious objection to a large water capacity is the time that the observer must wait before the final temperature is reached—the last creeping up being very slow.

I have also experimented with two other makes of gas calorimeter; but I have found that they are little more than copies of the Junker's instrument. The spasmodic variations of the outlet readings are quite as great; the water content in one of them is nearly 6 liters; and nothing has been done in either to reduce the inconvenient height, or to increase the facility with which they may be adapted to their surroundings.

Professor Threlfall has designed a calorimeter with a view especially to keeping a continuous record of the variation of the calorific power of gas. I have not seen this instrument or any complete account of it, but Professor Threlfall has informed me that he has kept the water content as low as he could.

I have had to examine existing calorimeters in consequence of a change in the law with regard to the testing of gas in London. From January 1 next the calorific value is to be taken; and it is the duty of the gas referees to prescribe the mode of testing. From a purely official point of view, the three calorimeters examined have the disadvantage that they are soldered up; so that it is impossible to tell what is inside them, or to see if they are made according to instructions.

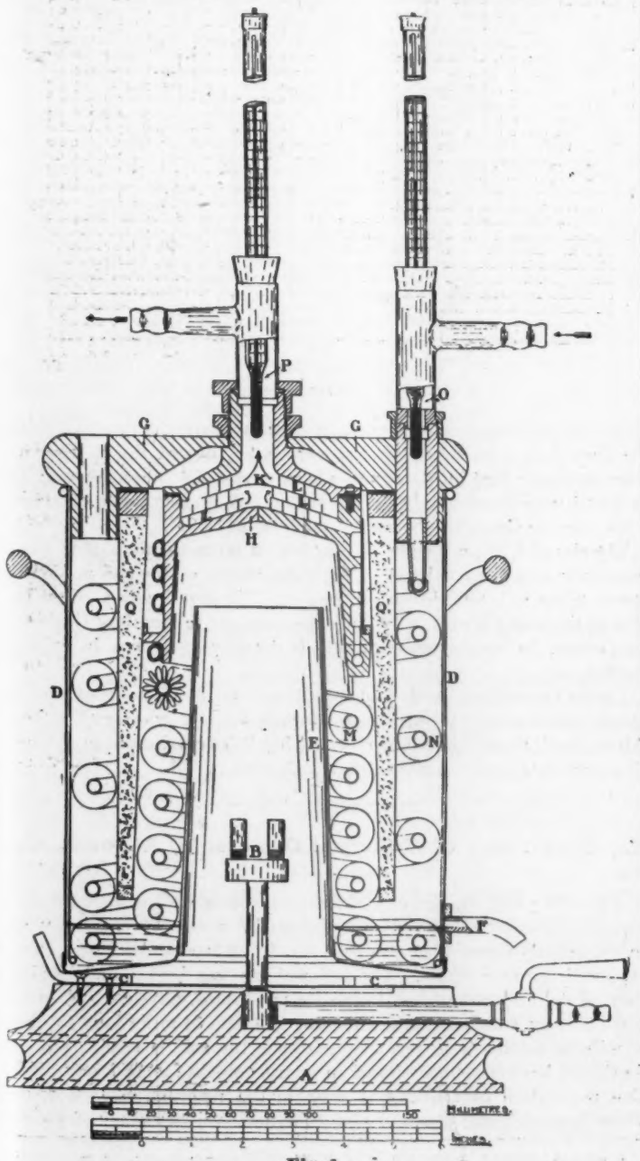


Fig. 1.

The calorimeter shown in section in Fig. 1 will, I believe, be found to be free from the disadvantages enumerated; and it has the peculiarity that it can be taken entirely to pieces in a few minutes, so that all parts may be examined.

A circular base *A* carries the gas pipe and tap terminating in a pair of No. 3 union jet burners *B*. The top surface is protected from radiation by a disk of bright metal, which is held down by the screws which fix the 3 centering blocks *C*. In the base, a governor may be inserted (or an ordinary balance governor may be used instead) to counteract the variation in pressure resulting from the working of the meter.

On the 3 centering blocks *C* rests a vessel *D*, of sheet brass, with a central chimney of thick sheet copper *E*. On one side, 1 inch from the bottom, a side tube *F* is fastened so that condensation water may drip from this into a measure placed to receive it. Of course, the vessel *D* may be turned round, so that the drip tube lies in any direction with respect to the gas inlet.

Attached to the lid *G* are the essential parts of the calorimeter. Beginning at the center, where the outflow is situated, there is a brass box which acts as a temperature equalizing chamber for the outlet water. Two dished plates of thin brass *K* are held in place by three scrolls of thin brass *L*. These are simply strips bent round, like unwound clock springs; and no attempt should be made to prevent all leakage from one spire to the next, as a little will be advantageous in encouraging temperature equalization. For the same reason, a little leakage from each spire to the one above may be allowed. The lower or pendent portion of this box is kept cool by circulating water, the channel for which may be made in the solid metal, as shown on the right side, or by sweating on a tube, as shown on the left. Connected to the water channel at the lowest point by a union are 6 turns of copper pipe, such as is used in a motor car radiator. I have employed a helix of copper wire wound round the tube and all sweated together—the well-known invention of Mr. T. Clarkson, of Chelmsford, who kindly sent me the wire for the purpose. A piece of such tube is shown in Fig. 2. I have no doubt, however, that squares of sheet

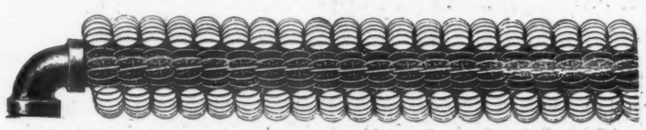


Fig. 2.

copper, as shown in Fig. 3, threaded on to the pipe and all sweated together, or a series of radially disposed copper strips cut so as to allow the pipe to be wound upon them and then be bent over outside, so as to make good sweating contact with it, would answer as well. A second helix of similar pipe surrounding the first is fastened to it at the lower end by a union. This terminates at the other end in a block, to which the inlet water box and thermometer holder are secured by a union, as shown at *O*. A similar outlet water box *P* and thermometer holder are similarly secured above the equalizing chamber *H*. The lowest turns of the two coils *M* and *N* are immersed in the water, which in the first instance is put into the vessel *B*.

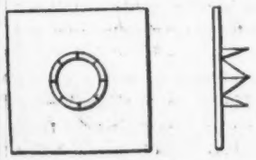


Fig. 3.

A further alternative for the inner but not the outer coil, which would, no doubt, answer well, could be made by winding a sheet of copper wire gauze (6 wires to the inch) into a cylindrical form, winding the pipe upon the gauze, and a second sheet of gauze upon the pipe, and then sweating all together.

Between the outer and the inner coils *M*, *N*, is placed a brattice *Q*, made of thin sheet brass, but containing cork dust to act as a heat insulator. The upper annular space in the brattice is closed by a wooden ring, and that end is immersed in melted rosin and beeswax cement, to protect it from any moisture which might condense upon it. The brattice is carried by an internal flange which rests upon the lower edge of the casting *H*. A cylindrical wall of thin sheet brass, a very little smaller than the the vessel *D*, is secured to the lid; so that when the instrument is lifted out of the vessel, and placed upon the table, the coils are protected from injury. The narrow air space between this and the vessel *D*, also serves to prevent interchange of heat between the calorimeter and the air of the room.

It will be noticed that the two thermometers for reading the water temperatures, and a third which may be added for reading the temperature of the outlet air, are all near together and at the same level; that the lid may be turned round into any position relatively to the gas inlet and condensed water drip that may be convenient for observation; and that the inlet and outlet water boxes may themselves be turned so that their branch tubes point in any direction. The instrument is convenient also in its small height; the thermometers being comfortably read when the instrument is standing on an ordinary table.

For regular testing purposes there is no need to use different rates of flow of water at different times. I therefore fasten an overflow water funnel (Fig. 4) on the wall at a convenient height over the sink, and connect it by india rubber tubes with a supply tap from the main and with the inlet *O* of the instrument. A uniform rate of flow is most easily attained by the use of a diaphragm in the supply pipe, which has been reamed out to allow the desired flow to pass through the instrument with the given head. There will be no occasion afterwards to adjust this.

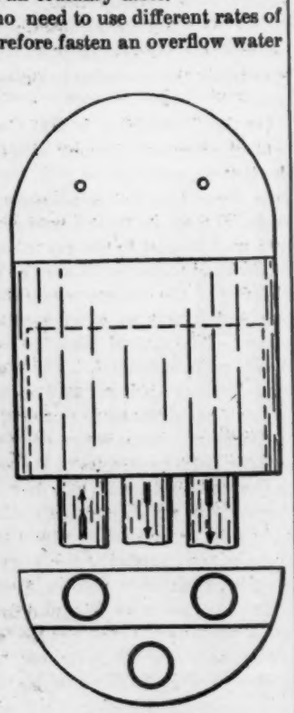


Fig. 4.

The flow of air to the burner is determined by the degree to which the passage is constricted at the inlet and outlet. I have found that if the three centering blocks are made of material $\frac{1}{16}$-inch thick, and the gas escapes by 5 holes $\frac{1}{4}$-inch in diameter made in the outer portion of the lid, the flames burn well, do not smoke, and an unnecessary excess of air is prevented from passing through the instrument. A sixth hole may be provided for a thermometer, so placed as to measure the temperature of the outlet gases.

Mr. Butterfield has examined the escaping gases, and finds that when the gas is burning at the rate of 5 cubic feet per hour they contain 7 per cent. oxygen and 8 per cent. of carbonic acid, from which he infers that the proportion of air to gas is about 8½ to 1. It follows from this that the correction for rise or fall of temperature of the air passing through the instrument is as near as possible ¼ of a calorie to the cubic foot of gas for each degree Centigrade of change. An examination of the effluent gas when only 4 holes were left open showed that the oxygen was reduced to 5.6 per cent.; but even so no trace of combustible gas could be detected.

A feature peculiar to this calorimeter is the absence of water cooling from all but the lower end of the chimney. Being made of copper $\frac{1}{16}$-inch thick, and with its base in contact with water, it is prevented from becoming hot enough to burn; while at the same time it is so hot that condensation does not occur upon its inner surface, and so the collection of the condensation water is simplified. Another advantage of the hot chimney is its extra aëro-motive power; so that the instrument can safely be made of far less than the usual height. The heat passing by condensation down the chimney into the water pool at the bottom is carried away by the water in the two immersed turns of pipe. Heat radiated downwards is in part reflected back by the bright metal shield over the base, but in so far as the reflection is imperfect, and the thin metal is warmed, it gives up most of its heat to the incoming air, which sweeps over it and so carries it back into the instrument.

It may be well to state that the object of measuring the condensation water is to find how much of the total heat is due to condensation of steam and cooling of the water down to the temperature of the drip. If this is subtracted, the result will give the heating value of the gas for operations in which the steam is not condensed, and this is generally known as the net, as distinct from the gross, calorific value.

In order to prevent corrosion of the metal surfaces by the continued soaking action of very dilute sulphuric acid and dissolved oxygen, the whole of the coil system can be lifted up out of the vessel *D* when the measurements have been made, and placed in a jar containing a very dilute solution of carbonate of soda. This source of destruction is likely to become more damaging in the near future than it has been in the past, in consequence of the great increase in the amount of sulphur which, without lime purification, will be left in the gas. Any deposit of lime that may be formed in the pipe system and equalizing box can be removed by passing very dilute hydrochloric acid through, and washing out with water. By these means it is hoped that the calorimeter will be available for daily use and be practically indestructible.

When I first considered how best the irregular outlet temperature of existing calorimeters could be made more uniform, I concluded that an inversion of the usual arrangement was essential, that, in fact, the gases should have plenty of space to pass gently through the instruments, and that the water should be taken through every channel strictly in series—all alternative parallel flow being prejudicial. The small pipe suitable for such construction, provided it is fortified with heat collecting ribs or wires, can still carry abundant water and absorb the whole of the heat, and it has a very small water capacity. At any rate such a construction, with the additional equalizing box, shows at times irregular variations of only 0.01° or 0.02° C., even with the total rise of 24° C. and without any device for in part shielding the thermometer bulb from direct contact with the stream of water. The water content of the coil and equalizing box is 300 c.c.; and of the space in the vessel *D* up to the overflow, 400 c.c.

It will be seen from Fig. 5—in which are plotted observations of the outlet temperature made every quarter minute from the time of lighting the gas—that, 5 minutes after lighting up, 21° out of the 22° rise have been attained; that in 10 minutes a further rise of ½° has occurred; and that in ¼ hour there is only $\frac{1}{16}$° remaining. A reading taken 55 minutes after starting showed the outlet water to be at 32.85°.

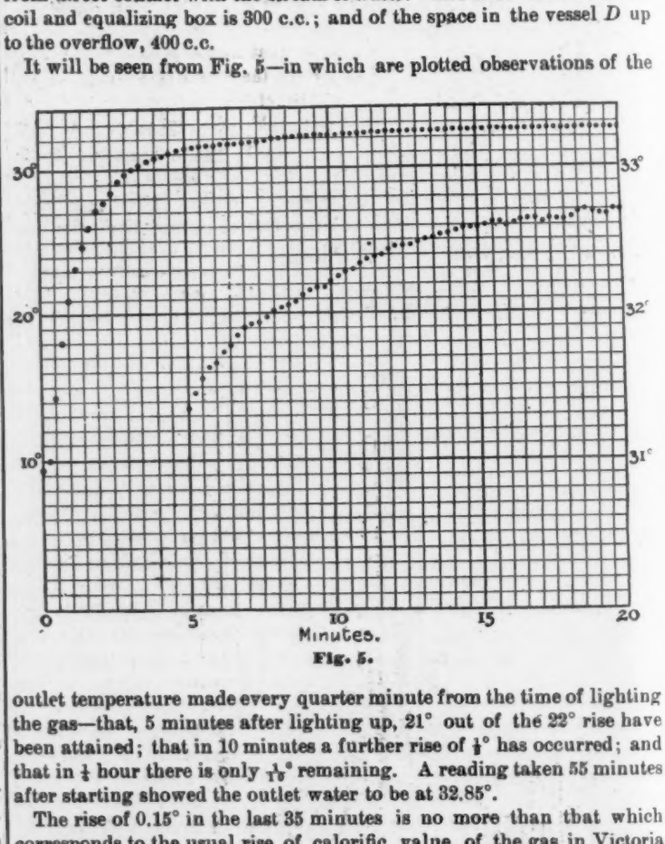


Fig. 5.

The rise of 0.15° in the last 35 minutes is no more than that which corresponds to the usual rise of calorific value of the gas in Victoria street, taken at intervals during the day. The small waves in the portion of the curve drawn to 10 times the scale are the result of friction in the meter, in consequence of which the governor was in constant motion.

I must express my indebtedness to Messrs. Griffin & Sons, of Sardinia street, who made a trial instrument for me when I was away in South Africa, and, therefore, out of reach. They have carried out my instructions accurately and to my entire satisfaction.

Eighteen Years of Municipal Ownership, Alameda, Cal.[1]

About 18 years ago the city of Alameda embarked in the business of lighting its streets and public buildings by means of electricity and more recently (since 1895) has been supplying private dwellings, stores, etc, with electric lights. The undertaking was begun and has been carried on under the most favorable conditions, physical and moral. The territory which comprises the city is about 3½ miles long by about a mile in width; it is level throughout; the soil is sandy; and the dwellings are evenly distributed on regular blocks facing broad streets. The population of the city is now in the neighborhood of 20,000. There is a navigable channel along the northern boundary of the city

1. By L. A. Redman, in Alameda *Daily Argus*.

by means of which fuel can be supplied to the power house of the city at the lowest cost. The morale of its citizens is probably nowhere excelled. Evidences of vice or misery will be looked for in vain. And in political affairs the city has been exceptionally free from the scandals and bickerings which usually disgrace municipal administrations. In the conduct of the city's business political considerations have almost always been subordinated to the welfare of the public. The Board of Trustees has been composed of men of probity and intelligence, whose chief aim has been the maintenance of good government. Political bosses have never controlled the city government and would not be tolerated.

Encouraged by these most favorable conditions the people of Alameda resolved to try the experiment of municipal ownership and operation of a lighting plant. The first step, taken in December, 1887, was the purchase of a plant, for which the city paid the sum of $40,000. It was subsequently ascertained that the plant cost the seller $18,200 to construct and equip. This plant consisted in part of 13 tall iron masts distributed throughout the city, carrying at their tops 54 arc lights in all.

This purchase was made in the belief that lights placed at the top of these masts would sufficiently illuminate the streets of the city. Experience has shown, however, that this belief was unfounded; and the city has been for many years chiefly (as Oakland always has been entirely) lighted by low lights. The machinery, poles, wires, etc., purchased by the city were of a primitive and cheap character. Part of the purchase price was realized from a sale of bonds for $25,000 issued by the city, $7,500 of which are still unpaid, although the original plant has almost wholly disappeared.

Several months ago I began an investigation with a view to ascertaining accurately the cost to the citizens of Alameda of conducting this business during the 18 years it has been engaged in it. Some idea of the muddled condition of the accounts kept by the city may be gathered from the fact that in response to a request from a citizen of Alameda for the same information I was seeking, the present President of the Board of Trustees stated that the furnishings of this information (which could have been readily obtained from books kept as are the books of private corporations engaged in the same business) was a "human impossibility!" He says that "the records of the electric light plant up to 1899 or 1900 were so kept that if the entire Board of Trustees went to work in conjunction with 4 expert accountants, it would take us 4 years of our natural lives to get a report that would be direct, full and unequivocal reply to your questions."

Bad as the case is, however, the picture was somewhat overdrawn by the President of the Board of Trustees. After laborious investigation I have succeeded, with the assistance of an accountant, in getting from the records of the city about one-half of the information which I was seeking, and, fortunately, was furnished the balance by a report made in April, 1896, by an accountant employed by the Municipal Ownership League, of Alameda, to ascertain the cost of municipal lighting in Alameda up to that time. There were no separate accounts kept by the city of the lighting business from the date of purchase (December 1, 1887), up to April 1, 1896; and it was not until June 30, 1903, that a bookkeeper was employed and regular, systematic account books opened.

The results of my investigation are shown in the tables which follow. These tables contain an accurate statement from year to year showing the amounts (with interest separately stated) expended for materials and labor, including purchase price of original plant, necessary to install and maintain the plant from December 1, 1887, to June 30, 1905, and show also the receipts from the sale of current to private consumers and other credits. By way of comparison I have added a table showing what a private corporation would have furnished public lights for, as shown by the experience of Oakland and Berkeley during the same period.

In a final column I have set forth the steadily rising tax rate in Alameda since the purchase of the plant. The Berkeley tax rate this year (85 cents) is a little less than the rate paid by the taxpayers of Alameda before they undertook to conduct this municipal enterprise (90 cents).

The following table is as accurate as it is possible to compile from the data now available. It has been simplified, however, by the omission of fractions of dollars. Interest on the original investment and on expenditures for construction, etc., which would not have been necessary had the city contracted for lighting, has been charged at the rate of 5 per cent. per annum. The bonds carry this rate, and it has been thought proper that interest at the same rate should be charged on the other items of expense referred to.

Table Showing all Expenditures and Receipts for Account of Alameda Municipal Electric Light Plant, from December 1st, 1887, to June 30th, 1905.

Year.	Investment and Construction.	Operating and Repairs.	Interest on Investment.	Receipts from Sale of Current, etc.	Actual Value of City Lighting.	Tax Rate (Fiscal Year.)
Calendar	$40,000 (a)					
1888 (b).	4,950	$10,250	$2,170	$1,370	$7,500	$0.90
1889.....	2,000	7,800	2,665	....	7,600	0.90
1890.....	6,100	8,850	3,035	....	10,200	1.15
1891.....	1,000	8,900	3,300	....	13,150	1.15
1892.....	2,100	9,700	3,350	....	13,150	1.15
1893.....	1,000	9,100	3,410	....	12,420	0.95
1894.....	2,400	8,600	3,485	....	12,690	1.00
1895 (c)..	20,250	16,200	4,110	4,300	18,300	1.22
1896.....	....	....	....	....	...	1.10
(Fiscal)						
1897.....	18,600	14,050	5,020	7,100	11,430	1.12
1898.....	6,550	15,040	5,700	7,000	13,710	1.05
1899.....	6,100	15,800	6,035	8,200	12,700	1.13
1900.....	4,400	18,800	6,425	6,900	13,500	1.20
1901.....	6,900	22,900	7,050	8,100	15,500	1.20
1902	12,300	25,000	7,900	13,000	16,800	1.25
1903.....	9,000	23,600	8,550	12,300	16,500	1.25
1904.....	12,900	24,400	9,285	15,000	16,650	1.38
1905.....	16,900	29,100	10,250	23,440	17,350	1.28
1905 (d).	15,500	....	....	....	....	....
Totals.	$188,990	$268,090	$91,740	$106,710	$229,250	....

(a) Original purchase price.

(b) For 13 months from December 1, 1887.

(c) For 18 months to July 1, 1896.

(d) From July 1, 1905, to November 1, 1905, taken from electric plant books, and which include expenditures before July 1, 1905, the warrants for which had not passed to the City Clerk's office.

Prof. C. L. Cory, of Berkeley, appraised the plant in 1904 at $70,000. This figure has been accepted by the city and has been entered as a basic asset on its books. In my computation of the loss to the taxpayers of Alameda in conducting this business I have accepted this estimate as correct, although, for reasons which it is unnecessary to state, I think it is too high. Making the necessary additions to and deductions from this figure for account of purchasers and depreciation since 1904, I find the present value of the plant to be $88,700.

From the foregoing figures the following conclusions are deducible:

Amount expended on account of investment and construction.	$189,000
Maintenance and operation	268,100
Interest	91,700
Making a total of	$548,800
Credits—	
Amount received by city from private consumers of light, etc..	$106,700
Value of public light supplied by city, as determined by experience of Oakland and Berkeley during same period	229,300
Estimated value of plant	88,700
Total credits	$ 21,700
Net loss to taxpayers to date	$124,100
	$548,800

The foregoing exhibit is, of course, a complete refutation of the statements repeatedly made even in official reports printed at the public expense, that municipal lighting in Alameda has been a successful business enterprise. These misleading and unveracious reports have been circulated far and wide, and have been instrumental in inducing other communities to repeat Alameda's folly. The people of Stockton, deluded by them, voted for municipal ownership, but, fortunately for that city, owing to legal difficulties, the project was never consummated. These reports are vitiated by devices familiar to all students of official reports of municipal businesses, such as omitting interest on the investment; failure to make deductions for depreciation of plant; employment of superseded figures in estimating cost under private enterprise, etc. The reports which have been issued from time to time by the city showing the cost of public lighting do not take into account purchases of machinery, supplies, etc., which had to be replaced again and again in the operation of the plant. They leave the impression that the difference between the expense of operation and the total outlay represents present existing values; whereas by depreciation of

the plant, consumption of supplies, etc., this margin may have largely or wholly disappeared. Of course, a correct estimate of the actual cost of lighting should include the difference between the present value of the plant, supplies, etc., and the amounts paid for the same.

In the reports issued by the city from time to time showing cost of lighting as compared with what the city would have had to pay to a private corporation it is assumed that the city would have had to pay $7.50 per arc light per month, and that the cost of lighting public buildings under contract would be 10 cents per kilowatt; whereas Oakland and Berkeley are furnished with arc lights for from 20 to 25 per cent. less than this, and lights for public buildings for 5 cents per kilowatt.

In the annual report for the year 1904 issued by the city, it is assumed that public lighting for that year furnished by a private corporation would have cost the people of Alameda $22,037; whereas at the rate the people of Berkeley paid that year the service which the people of Alameda received would have cost less than $15,000.

The sum of $40,000 originally paid for the plant was derived from the sale of bonds for $25,000 and $15,000 in cash which was in the city treasury as part of the proceeds of a sale of sewer bonds. The interest on this sewer bond money has never been charged up against the electric light plant investment, and is not mentioned in any of the electric light reports. The unusually high rate of taxation for the year 1904 ($1.38) was due to the payment of $13,000 of bonds denominated as "sewer bonds," the money for which, however, had been used in part payment of the original purchase price of the electric light plant. The interest on the $25,000 of bonds appears in some, but not in all, of the electric light reports. Nothing has been charged off in these reports for depreciation (except in one instance) leaving, as above stated, the impression that the difference between the total expenditures and the operating expenses represents present values.

(To be Continued.)

Fact and Idea in Engineering and Architecture.

In his address, as President of the Brooklyn (N. Y.) Engineers' Club, at its last meeting, MR. RICHARD S. BUCK said these things:

It is a sort of travesty on human intelligence, a sort of paradox, that we must learn how to succeed from failure, that we must learn what we cannot do before we learn what we can do. That there should be such a great disparity between effort and accomplishment, is due to our failure to comprehend, or comprehending, our failure to use the correct relation between idea and fact. The idea is the function that the human mind contributes to the problem of accomplishment; it is a function that has a much broader range of negative than positive values. The fact is what the laws of nature contribute, and is a fixed quantity. When the two conflict, the idea always cancels out.

Ideas are unquestionably most valuable stock in trade when intelligently directed and properly subordinated to facts, but if you let an idea get the best of you it is worse than a fractious automobile or a strong minded wife. The idea which is of value is the one which is adjustable to all accompanying facts, be they friendly or otherwise. You must always fit your idea to the facts. You cannot fit the facts to your idea. I do not mean to deny the value of ideas which pass beyond the range of demonstrable fact. There is even great value in imagination. Without soaring ideas born of imagination there could be nothing new, no progress; our field of mental action would be narrowed to archaic limits. But the paramount aim, accompanying a healthy idea, should be to seek the facts governing its object, the real tangible conditions to be met, whether they are what we want to find or not.

In no profession is a proper comprehension or utilization of the correct relation between idea and fact more essential to success than in engineering. Engineering can be fairly defined as the science of discovering facts and the art of using them. Here the fact must be kept constantly in control and the idea subordinate, otherwise there is short shrift for the effort. In other professions the idea has a wider, more independent range—more rope as it were—and in enjoyment thereof can, even when out of harmony with fact, reap success (or apparent success) of considerable duration.

In our kindred profession of architecture, while a certain modest observance of fundamental facts must be maintained, this is deemed by architects as a bar sinister on the architectural escutcheon. It is on those rainbow hued conceptions, those lofty flights of fancy which have expression in beautifully rendered drawings from which all inharmonious accuracy is carefully eliminated, that the architects lavish their devotion. The conversion of these conceptions into accomplishments is, according to the architectural code, the function of "engineers and other mechanics."

Some time ago at a memorable gathering of architects and artists, where a few engineers were invited probably for the purpose of inaugurating a sort of college settlement work among this benighted class, an eminent architect during the course of other enlightening remarks said that it was the proper function of the architect to conceive, design, express, and the proper function of the engineer was to execute what the architect conceived, designed and expressed. This would be a most delightful division of labor—for the architects—were the subordination of idea to fact in the scheme of accomplishment reversed. But there has as yet appeared no sign of such reversal and until it occurs, successful design leading to successful accomplishment will continue to be more dependent upon knowledge of homely facts than upon the training of the Ecole des Beaux Arts, or upon those accomplishments that command the Prix de Rome. Experience must enter into the very first inception of a design, or else, when it appears later, as it inevitably must before the design is converted into an accomplishment, it will have to tear to pieces, patch up, and replace rainbows with sordid earthly material. This is a most painful, a most trying operation.

But while subordination of idea to fact, of imagination to experience, is the fundamental principle of accomplishment, it does not hold that the architecturally trained mind cannot render or has not rendered valuable service in engineering designs. The study of those forms and proportions emerging from the efforts and conflicts of centuries as most fitted to endure and become standard types; the power to build by word and picture for the mind's eye those conditions which are often hopelessly intricate and difficult for the engineer, less versatile in picture drawing; freedom from the deterring influence of facts sometimes distorted to the eye of the engineer in his devotion to materialism; these are the resources wherein the architect is more richly endowed than his engineering brother; but in using them it behooves the architect to keep his feet on the ground, and in constant touch with the facts which engineering experience can alone supply. On the other hand, it equally behooves the engineer, when occasion requires, to lift himself above the dead level plane of materialism, and he should educate himself to this end. In their differences the engineer and the architect are both right and both wrong; and to minimize the wrong and promote the right they should both cultivate the habit of using the other's spectacles. Each should study the other's problems more—do more studying and less teaching.

The crowning glory of the architect's creed is to build into utilitarian structures that artistic beauty without which he thinks, not without some show of reason, construction is but a blot cumbering the landscape. But when you seek to establish a rule whereby to judge the beautiful, and go among the living architects to learn, you will find just about as many different rules as you will find architects. No architect will ever agree that the work of another architect is all right until the latter has been long enough dead to be comfortably removed from the field of competition. Nothing enhances the merit of an architect's work among his fellow architects as much as for him to pass peacefully "over the range."

Now engineers are always eager to agree, as we have recently seen so signally exemplified in the case of the Panama Canal, or to come a little nearer home, in the case of eyebar chains and wire cables, which, like Banquo's ghosts, persists in haunting us.

When the architects agree among themselves as to what is correct and beautiful in those forms of construction which they have studied for centuries; when they can go beyond the now narrow limits of stock masonry construction; when they can fully understand the legitimate lines of development of steel and concrete; when they can refrain from cumbering the prime object of a work with a mass of finely drawn ideals and fancies; when they have eliminated from the field more legitimately their own the faults and controversies that crowd there; then they can with propriety *demand* that the material minded engineer sit at their footstool and learn how to beautify his work. Until they do all this it behooves them to handle engineering problems with modest and gentle hands, and to devote themselves more assiduously to self education in the rigid school of fact.

The controlling principle of engineering works is not to tickle the fancy or please the eye. This is even so of that unfortunately conspicuous form of engineering construction—the bridge. The bridge has serious, sordid, somber business to do, and it is seldom that conditions permit it to do this business with the same pleasing grace that we find in so many of our modern buildings—such as that temple o

intellect that graces Longacre Square, the Times Building, or that glorious emporium of drygoods and art, the new Wanamaker store.

Some of us, for quite a while past, have been undergoing an heroic course of treatment in bridge aesthetics. All the way from the carefully studied French art of Hastings and the bold, variegated and versatile conceptions of Hornbostel, down to the highly cultivated ignorance of Montgomery Schuyler and the New York Times and the Calliope chorus of the Municipal Art Society, we have endeavored to absorb and mentally digest. We have been yanked from a school of stern severity, utilitarianism and economy, and translated to an atmosphere of aesthetics filled with colonnades, peristyles, facades, triumphal arches, lofty columns, architectural motives and skinned-face masonry, where it is a crime to breathe the word economy, and where steel and concrete constructions are contemplated with as much abhorrence as a client who objects to the union rate for architectural services of "5 per." We are prayerfully hoping that this strenuous education will not develop mental appendicitis and that in time we may comfortably bear the proud title of "Doctor of Aesthetic Engineering." We are deeply grateful to those who would kindly lead us in the paths of better work, but it is "the back of me hand and the sole of me foot" to those who would drive us.

I do not claim for the engineer individually or as a class that immunity from error that we would all like so much to enjoy and which none of us do. I do not claim that his tribulations and his failures to satisfy are generally due to lack of appreciation from the outside. The rule is that his trouble lies in his own lack of adjustment of ideas and facts.

In these days of great engineering enterprises, demanding bold conception, strenuous thinking, and comprehensive and rapid designing where it is hard, in adhering to what we have already gathered under our own hats, to do the things we want to do and attract attention to ourselves in the multitude, where it is a wearisome grind to grub for facts often so hard to turn up, where we often have to go for these among the works of rivals whom we are striving to outstrip; where these facts have a nasty habit of conflicting with our desires, the temptation is often irresistible to try to leap from the freshly conceived idea to its accomplishment instead of plodding through the intervening mass of unpleasant but uncontrolling facts. Or else we use those facts that please us and ignore, or try to cover up, those that do not. This dangerous game of fooling oneself and playing that he is fooling the world breaks the neck of many a hardly effort.

The engineer who gets there is the one who can face squarely and without bias in favor of his own mental products, all facts favorable and unfavorable and can shape his course by a proper balance among them. The engineer who fails to do this has to consume much time and gray matter constructing explanations why he has not succeeded.

We are all more or less disposed to humor and coddle our own ideas as we do our own children, and to regard with a critical eye or distinct disfavor the other fellow's ideas as we do the other fellow's children. Many an idea is spoiled by too much parental devotion and too exclusive an atmosphere. An idea that can grow into something worth while, can evolve into an accomplishment of value, must be capable of enduring strenuous contact with facts and other ideas. We cannot shape its career with our imagination and desires alone.

Accomplishment in engineering to-day is far less the work of the inspiration of individual genius than it was a quarter of a century ago.

Our professional mission to-day is not to strive to impress upon the world the capabilities of our minds, nor try to build monuments on which we can write our names in solitary state, but to pick carefully out of the world's vast storehouse of experience those facts best suited to the purpose of our work and to mold patiently and humbly our ideas to them.

We may not thus acquire the fame of the artist or the golden emoluments of the thrifty architect, but we will at least attain some share of success and satisfaction.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE State Commissioner of Gas and Electricity has authorized the Kings County Electric Light and Power Company to increase its capital from $5,000,000 to $8,200,000. The Company's application was for the right to increase its capital to $10,000,000. The Company's main place of business is in the borough of Brooklyn.

MR. JOHN MESSLER has resigned from the service of the Quincy (Ills.) Gas, Electric and Heating Company, to become an active member of the local firm of Messrs. Miller & Butler, electricians and dealers in electrical supplies.

FANS, blowers and exhausters for heating and ventilating, mechanical draft and other purposes, are described in a booklet recently issued by the Green Fuel Economizer Company, of Matteawan, N. Y. This Company has many years installed fans and exhausters for mechanical draft in connection with the Green Fuel Economizer, and has long been aware that important improvements could be introduced in air-moving apparatus. The amount of power required for driving is often considerable, and some builders have, under stress of competition, suggested and constructed high speed fans of small size, where true economy would indicate the use of larger and slower moving fans. The Green Fuel Economizer Company it should be noted does not contract for the engineering of plants nor for the installation of heating and ventilating plants in competition with the heating and ventilating contractors. Its general equipment at Matteawan has lately been largely increased.

"F. S. J.," writing from Omaha, Neb., incloses the following: "Judge Green sitting in the District Court of Council Bluffs, Ia., some days ago sentenced David T. Stubbs to 18 months' imprisonment in the Fort Madison (Ia.) Penitentiary, for the larceny of a sum approximating $2,000 while acting as cashier for the Council Bluffs Gas Company.

"B. A. R.," writing from Atlanta, Ga., under date of the 27th December, says that Mr. J. L. Fleischer, a shareholder in the Macon (Ga.) Gas Light and Water Company, objects to a renewal of the Company's charter, which will expire February 17 next. He says he has a right to demand an accounting and distribution of assets at that time; notwithstanding the fact that the Directors are now giving notice that they will apply for a renewal of the charter for 20 years, and will want enlarged powers that will enable them to own light and water plants in other cities and towns in Georgia and to operate electric light plants. Mr. Fleischer contends that an undertaking of such a character is of vital importance, and the consent of every stockholder is absolutely necessary; whereas he has refused to give his consent, and by order of Judge Z. A. Littlejohn, of Sumter, Judge Felton, of Bibb, being disqualified because he is a stockholder, has secured an injunction restraining the Macon Gas Light and Water Company from doing anything in the premises until a legal hearing can he had. The hearing is set for 10 days after service of papers.

"A. L. S.," writing from Yonkers, N. Y., under date of the 30th December, incloses the following, which has to do with the plant of the Northern Westchester Lighting Company at Ossining, N. Y.: "During the past summer and fall the people of this village have had ocular demonstration of the fact that 'something was doing' in gas matters, from the busy gangs of men that were to be seen hard at work in the streets in all directions, digging trenches, laying pipes, filling in and then with gravel and steam roller making the roadway not only as good, but even better, than it was in the first place. While all this activity meant the laying of some miles of new street mains and the extension of the gas service far beyond the boundaries of the village—and the betterment of the service within the corporation limits—down at the gas works in Water street, other undertakings of equal magnitude were underway in the virtual rebuilding of the plant, which in effect has more than doubled its manufacturing capacity, while it has lifted the entire property out of its former appearance of slovenly neglect and transferred it into a prosperous and businesslike looking concern. One of the most costly features of the improvements at the works was the installation of a second and much larger set of gas making machines. It has a capacity of 350,000 cubic feet of gas every 24 hours, enough to last Ossining a week. This machine and the one put in by the old Company, about 4 years ago, which has been thoroughly overhauled, form a duplicate apparatus that provides for almost any contingency that may arise. Besides the machines, a duplicate engine and blower plant has been set up in the space formerly occupied by the benches, or coal gas apparatus, which were taken down, and improved methods and new machinery and new fittings are to be observed in all parts of the works. Coal is hoisted to the second floor of the works by an elevator whose 20 feet of shafting below ground was sunk only after a stubborn fight with a bed of quicksand into which it was built. The floors of the works are of concrete, a great advance over the old board and mud coverings of former times, and the buildings have been enlarged liberally, and remodeled where needed, and furnished with roofs, which latter necessity several of them had not had for years. In addition to all this the grounds around the works are undergoing a transformation in the matter of grading and filling in. A fine wall, 500 feet long and 12 feet high, built in the most substantia[l]

manner of stone laid in cement, has been erected along the Kilbrook, which forms the northern boundary of the gas property, protecting effectually the works against any freshet like that of 2 years ago. An authority on gas making in giving advice to parties about to introduce gas in a community writes: 'Those who have in mind the introduction of gas will do well to intrust the preliminaries to a competent gas engineer, as the money expended for his services will undoubtedly be more than saved in having the plant properly proportioned to present and probable future needs.' And it is because the work at the gas plant as well as in the streets generally has been under just such an engineer in the person of Superintendent W. L. Secord, that we believe the Ossining gas works when completed will be a model of their kind and satisfactory in every particular. Money certainly has not been spared in making improvements, and professional knowledge has been on the spot all the time, directing the expenditures into channels likely to give the best results. It is over 100 years ago, or, to be exact, in 1793, that William Murdock first lighted his house and office in Redruth, Cornwall, England, with gas made from coal. Gas was first used in this country in the city of Baltimore, in 1821, and was introduced into this village in 1855. What was a novel and convenient means of illumination 50 years ago, has now become a necessity for lighting, cooking, heating and power purposes. Of late years our local gas supply has not been satisfactory, principally because many of the built-up sections of the village had outgrown the small street mains with which they had been supplied when but sparsely settled, and also because of poor service pipes connecting houses with mains, poor piping in houses and poor burners attached to the piping. The coming of the Northern Westchester Lighting Company has changed all this. The first thing the Company did last June when it took hold, was to send men around town changing the burners free, for all who would ask it, until about 10,000 imported Bray burners had been put out in this way. Then the Company went at the mains, the service pipes and the works, and it has been busy ever since and is likely to be for some time to come."

THE City Council of Ingersoll, Can., has permitted an extension of time to the proprietors of the Ingersoll Gas Company, under which they may complete their arrangements under the public lighting contract. The period now goes to June 1st, 1906.

WE understand that Messrs. W. C. Noxon and Charles Swabey, of Toronto, and J. W. McCutcheon, of Petrolia, Can., are among the provisional directors who have incorporated the Petrolia (Ont.) Gas Company, the avowed objects of which are the manufacture of gas and electricity for light, heat and power purposes. The concern is capitalized in $40,000.

WE are indebted to a correspondent in Portland, Me., for the information that the American Gas Company, which controls the gas supply of Bangor and Brewer, Me., has authorized Superintendent Gould to announce that from the 1st inst. the Company will base the selling rate on two charges—a charge for 1,000 cubic feet of gas consumed and a service charge. The service charge will be made to all consumers, and it is fixed at 25 cents per month per meter. The gross price of gas is reduced from $1.65 to $1.25 per 1,000 cubic feet, and from the latter rate a discount of 10 cents per 1,000 will be allowed to all who pay before the 10th day of the month in which the bills are rendered. Mr. Gould believes that dollar gas will rule in Bangor before the century is much older.

THE following notice, issued the closing week of the old year by the proprietors of the Boston Consolidated Gas Company, explains itself: "The Boston Consolidated Gas Company begs to announce that, in fulfilment of the promise made to patrons in June last, the price of gas after January 1st, 1906, will be 90 cents net per 1,000 cubic feet. This second reduction in price is made voluntarily, 6 months before the time required by the terms of the consolidation. Commencing January 1st, 1906, bills will be delivered by our collectors instead of being distributed by bill deliverers. The object of this is to insure prompt and correct delivery of bills and at the same time afford those customers who desire it the opportunity of paying their bills on presentation. For the further convenience of our customers the Company has established local pay stations [here are named the merchants, 5 in number] with the following merchants who are authorized (without expense to the consumer) to accept the payment of bills."

GENERAL A. E. BLISS, according to the Boston *Post*, who has for some years past been Superintendent of the Malden (Mass.) Electric Company, is now in charge as General Superintendent of the Malden and Melrose Gas Light Company, the Suburban Gas and Electric Company, the Haverhill Electric Company and the Springfield Gas Company, all of Massachusetts.

THE annual meeting of the Consolidated Gas Company, of New York city, will be held the 22d inst. Let us hope that a President will then be chosen.

MR. ARTHUR HART has accepted a responsible position in the service of the Hannibal (Mo.) Company. He was formerly in charge of the plant at Mattoon, Ills.

MR. C. H. DUNBAR, Manager of the Houston (Tex.) Gas Company, says that an important concession in the selling rates will be announced prior to February 1st.

MR. JOHN J. MAGILTON, head of the auditing department of the Schenectady (N. Y.) Illuminating Company and of the Mohawk Gas Company, was rather surprised by his "merry men," the afternoon of December 23d, when they presented him with a very appropriate Christmas reminder. He managed to respond in feeble terms to the presentation speech.

THE proposed gas plant for Elkader, Ia., is an assured fact. At the special election held to indorse or reject the franchise the vote was: For, 168; against, 64.

THE New London (Conn.) Gas and Electric Company will shortly be housed in its new office quarters in the Crocker House annex on Union street. The customers will be as pleased as the employees when the change is completed.

MR. WILLIAM KIRKWOOD, in the *Metal Worker*, says that a very simple but highly satisfactory plan for working in gas infected receptacles or in ditches and manholes likely to contain gas is for the workman to secure a length of common garden hose, fixing one end where it will insure a supply of fresh air and holding the other end in his mouth while he descends into the pit or other dangerous location. This experiment, which is so elementary as to make it almost necessary to apologize for giving it space, is yet, as far as we can learn, by no means generally used. An instance is cited where it was necessary for a gas company in changing its plant from coal to water gas to clean out the main piping about the plant, to do which it was necessary to drill 1¼-inch holes into the pipes in order to admit blasts of steam. For days workmen were baffled in their attempts to drill these holes by the great amount of gas escaping, and venturesome machinists were overcome one after another until an inventive Scotchman tried the hose proposition and was enabled to work hour after hour until the work was completed. The same workman used the same plan in approaching and repairing a gas meter which was located in a manhole a number of feet below the street level in Chicago. Previous to his successful use of the hose a large number of men had endeavored, in some cases with serious results, to descend into the manhole.

At the annual meeting of the shareholders in the Chambersburg (Pa.) Gas Company the Directors elected were: George H. Stewart, M. C. Kennedy, T. M. Nelson, W. K. Sharpe, Irvin C. Elder, A. Buchanan and C. O. Wood.

THE Mayor of Haverhill, Mass., in that part of his annual message relating to the public lighting of the city, had this to say about the Superintendent thereof: "I deem it my duty to publicly say a word for the Superintendent of Street Lighting, Mr. George F. Morse. He has served the city faithfully for many years. I have always found him to be most faithful, obliging and attentive to his duties at all hours of the day and night. Our citizens can rest assured that in Mr. Morse they have a man who earns by faithful service every dollar that is paid him."

THE South Hadley Falls (Mass.) Electric Light Company seems to be in earnest over the proposition to furnish a gas supply to the residents. The selling rate offered is $1.45 per 1,000 cubic feet.

HEREAFTER the net selling rate per 1,000 cubic feet, as arranged by the proprietors of the Newport (R. I.) Gas Light Company, is to rule at $1.10 per 1,000 cubic feet.

THE Public Service Corporation has reduced the selling rate for the gas supplied by it in Hudson county, N. J., from $1.10 to $1 per 1,000 cubic feet.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

MONDAY, JANUARY 8, 1906.

The Market for Gas Securities.

The quotations for local gas shares are decidedly lower for this week than last. Consolidated closed to-day (Friday) at 178 to 179, and the decline was accomplished on comparatively small trading. New Amsterdam 5's show a round loss on the previous quotation. They are, however, worth now more than at any other time in their listing.

Brooklyn Union is quoted at 170 to 180, and the 5's are at 112 to 113. Peoples, of Chicago, holds its own fairly well, and Laclede preferred is 95 to 110. Cincinnati is going on to 110, and the change in Washington gas is slight. The dividend in the shares of the Louisville Gas Company is payable to-day.

Gas Stocks

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JANUARY 8.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	178	179
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	275	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	107	109
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's	1,250,000	1,000	105	107
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	170	180
" " Bonds (5's)	15 000,000	1,000	112	113
Bay State	50,000,000	50	⅝	..
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" " Bonds, 5's	3,250,000	1.000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6 s)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co	29,500,000	100	106½	106¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,683,750	100	..	95
Preferred	3,026,500	100	107¼	108
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	82	85
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	361,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104¼	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	110	110½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100		..
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1 000,000	1,000	60	65
Louisville	4,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,500,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101¼	101½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000		104¼	105¼
San Francisco, Cal	15,800,000	100	58¼	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	290¼	293¾
First mortgage 6's	600,000	..	.	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600.000	50	230	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., Dec. 13, 1905.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Jan. 15th 1906, to stockholders of record at the close of business December 30, 1905. Checks will be mailed.

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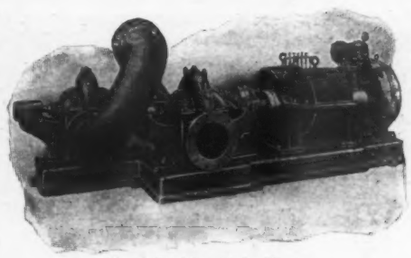

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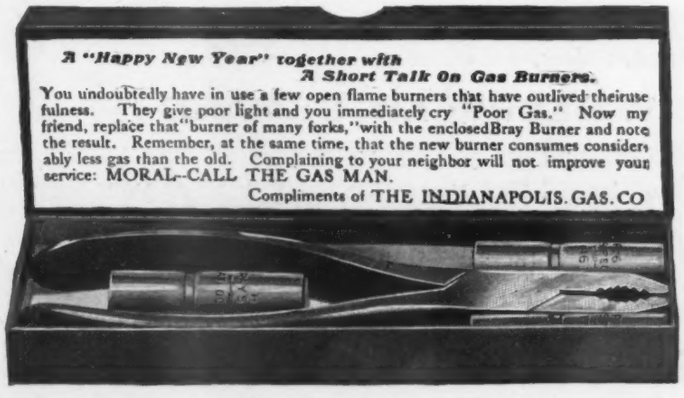
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You undoubtedly have in use a few open flame burners that have outlived their usefulness. They give poor light and you immediately cry "Poor Gas." Now my friend, replace that "burner of many forks," with the enclosed Bray Burner and note the result. Remember, at the same time, that the new burner consumes considerably less gas than the old. Complaining to your neighbor will not improve your service: MORAL—CALL THE GAS MAN.
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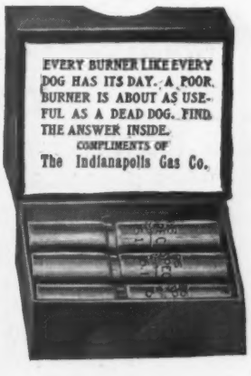
EVERY BURNER LIKE EVERY DOG HAS ITS DAY. A POOR BURNER IS ABOUT AS USEFUL AS A DEAD DOG. FIND THE ANSWER INSIDE.
COMPLIMENTS OF
The Indianapolis Gas Co.

Note what this Company says about the burner of many points. *Kindly remember that the Indianapolis Gas Company is not trying to advertise Bray Burners.* It is simply trying to make friends of all its consumers by *giving them satisfactory service.*

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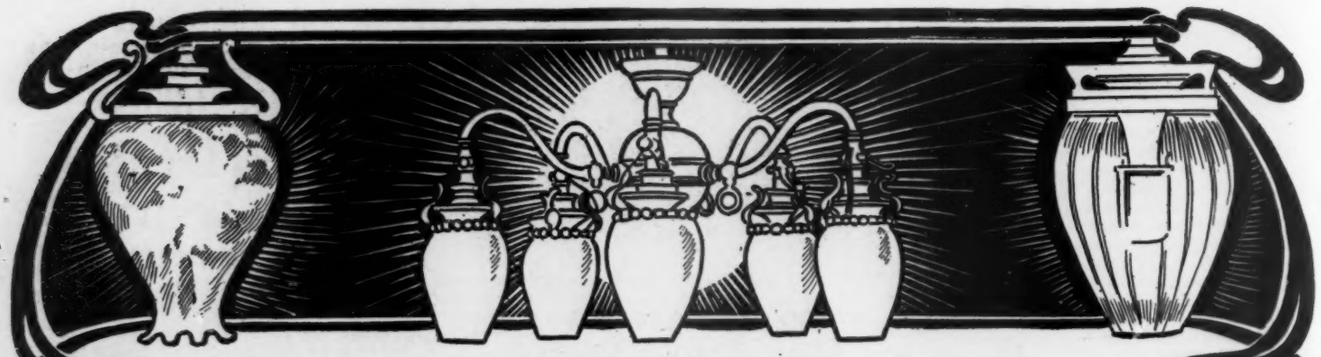

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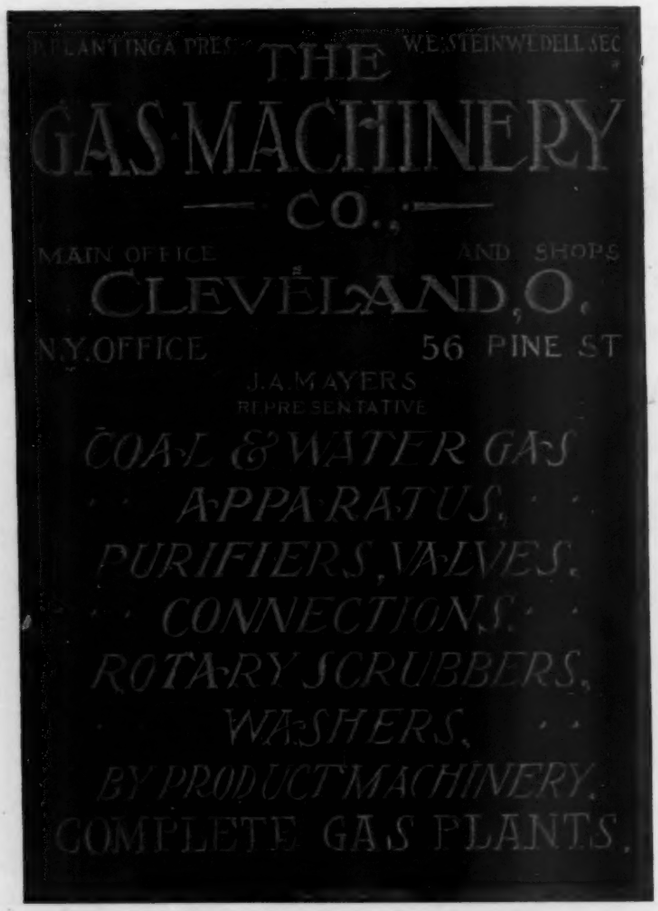

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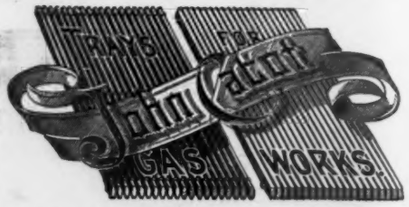

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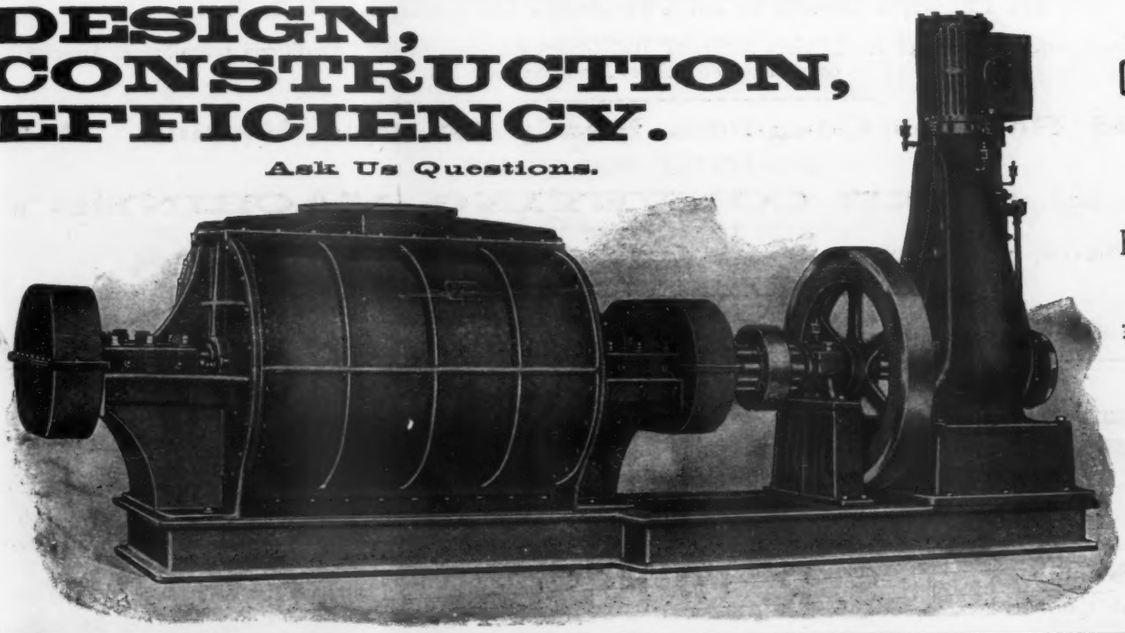

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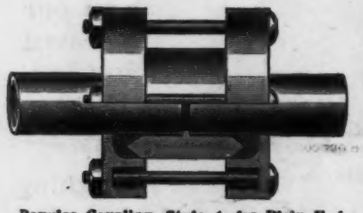
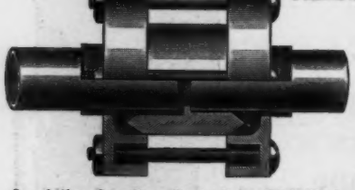
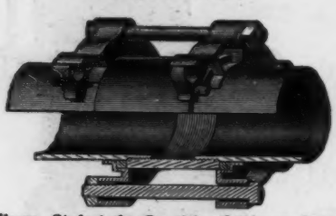


Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe.



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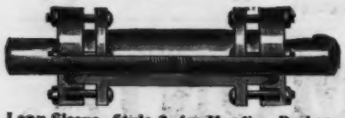

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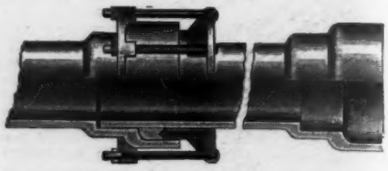
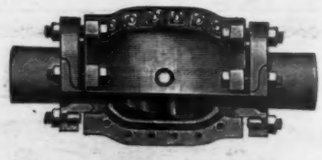
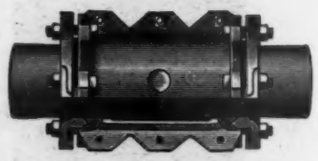


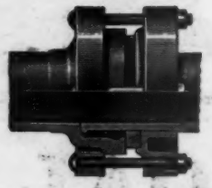
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



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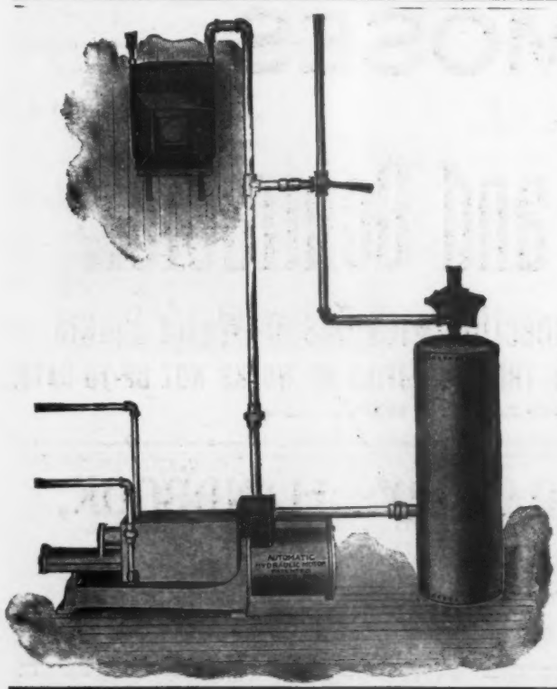

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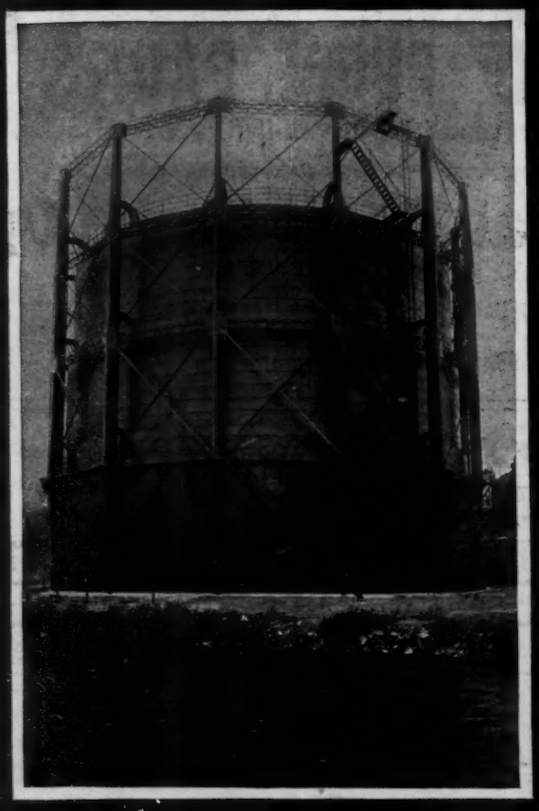

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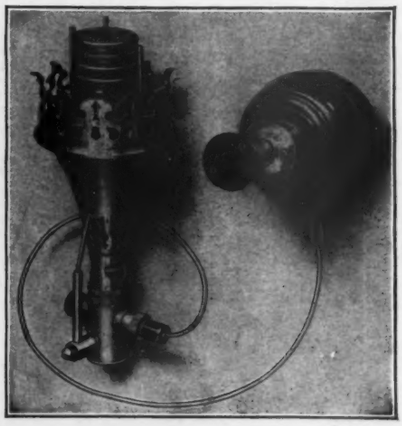

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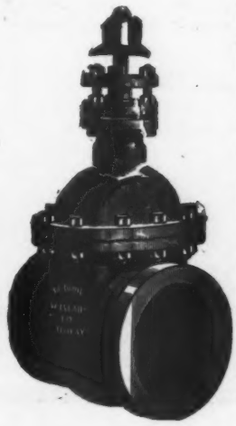

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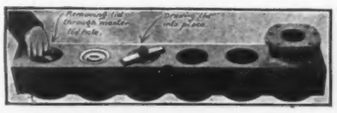

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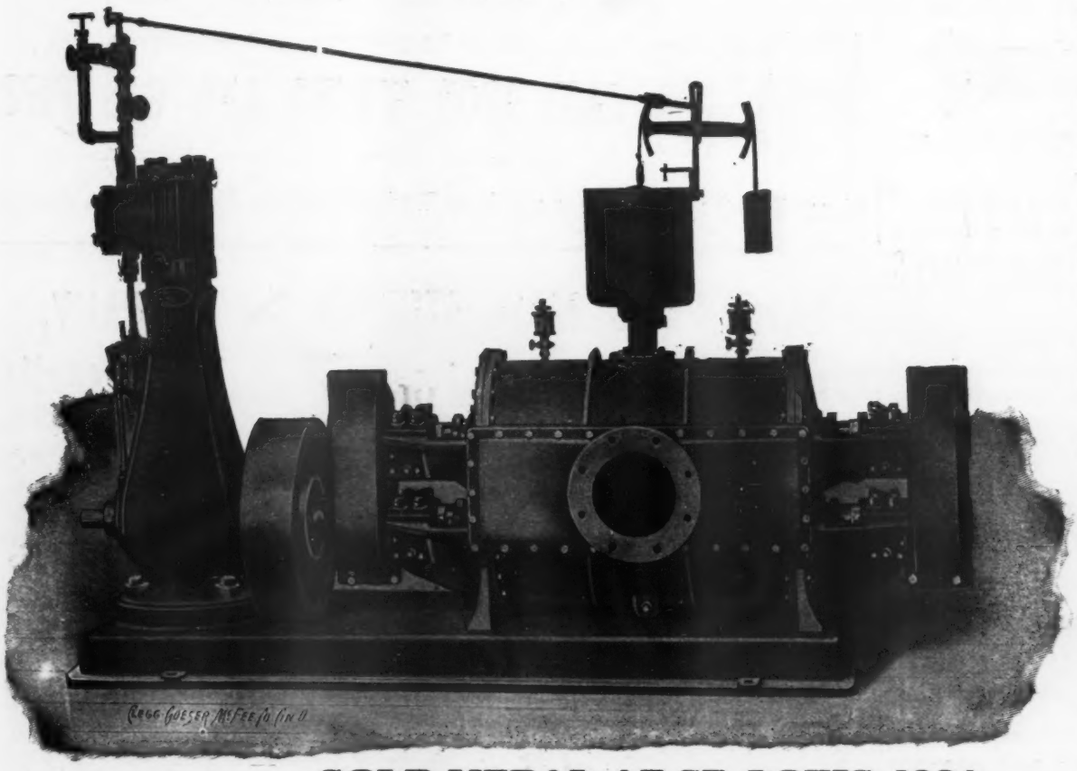

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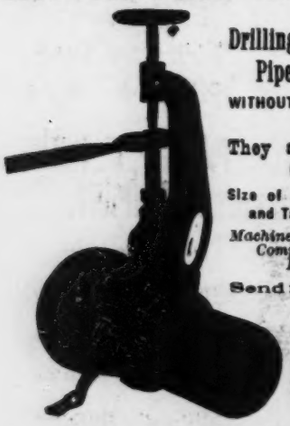

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Mueller Dry Pipe Tapping Machines, including the Mueller "Regular," "Our Special" and "Our Special No. 2," comprise a line unequal for their class of work. They are made strong, are easily attached to the pipe, and are easy to operate under all conditions of use. All dry pipe machines make taps from ⅜ to 3-inch in any size of pipe. Unconditionally guaranteed. Catalogues upon application.

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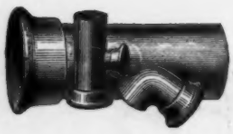

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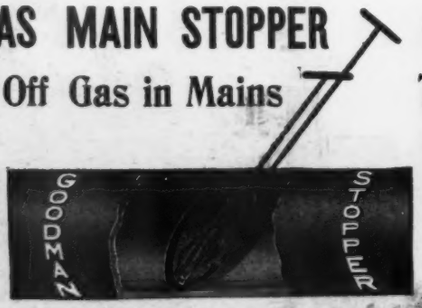

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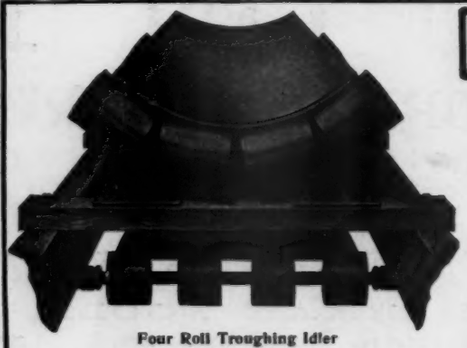

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

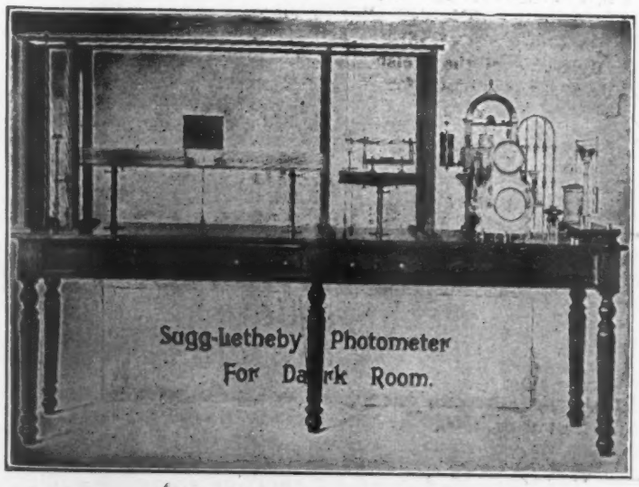
JANUARY, 1906.

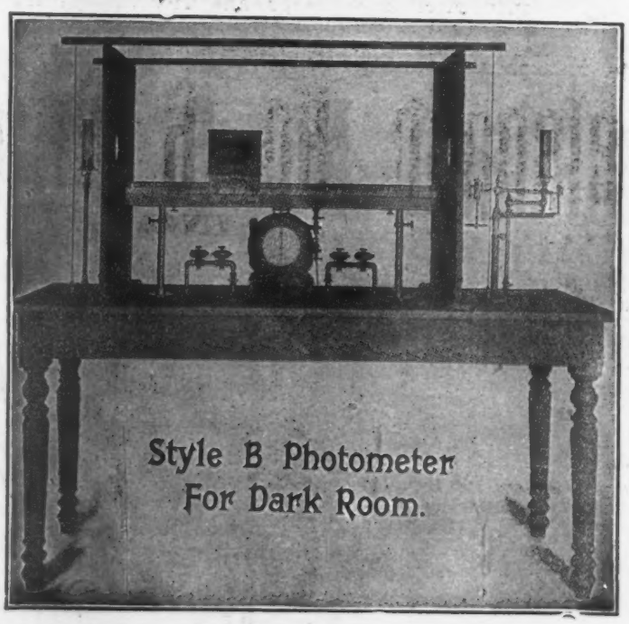
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.
Mon.	1	10.40 PM	6.20 AM
Tue.	2	11.40 FQ	6.20
Wed.	3	12.40 AM	6.20
Thu.	4	1 30	6.20
Fri.	5	2.30	6.20
Sat	6	3.20	6.20
Sun.	7	4.20	6.20
Mon.	8	5.10	6.20
Tue.	9	No L.	No L.
Wed.	10	No L. FM	No L.
Thu.	11	No L.	No L.
Fri.	12	5.20 PM	8.10 PM
Sat.	13	5.20	9.10
Sun.	14	5.20	10.20
Mon.	15	5.30	11.30
Tue.	16	5.30	12.40 AM
Wed.	17	5.30 LQ	1.40
Thu.	18	5.30	2.50
Fri.	19	5.30	4.00
Sat.	20	5.30	5.10
Sun.	21	5.40	6.20
Mon.	22	5.40	6.20
Tue.	23	5.40	6.20
Wed.	24	5.40 NM	6.20
Thu.	25	5.40	6.20
Fri.	26	5.40	6.20
Sat.	27	5.40	6.20
Sun.	28	5.40	6.10
Mon.	29	9.30	6.10
Tue.	30	10.20	6.10
Wed.	31	11.20	6.10

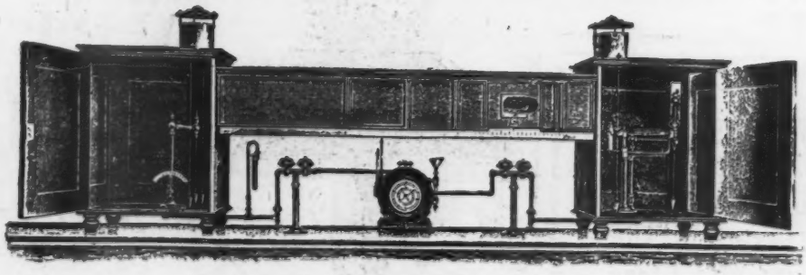
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

JANUARY, 1906.

Day of Week.	Date.	Table No. 2. New York City. All Night Lighting. Light	Extinguish.
		P. M.	A.M.
Mon.	1	4.30	6.30
Tue.	2	4.30	6.30
Wed.	3	4.30	6.30
Thu.	4	4.30	6.30
Fri.	5	4.30	6.30
Sat.	6	4.30	6.30
Sun.	7	4.30	6.30
Mon.	8	4.40	6.30
Tue.	9	4.40	6.30
Wed.	10	4.40	6.30
Thu.	11	4.40	6.30
Fri.	12	4.40	6.30
Sat.	13	4.40	6.30
Sun.	14	4.40	6.30
Mon.	15	4.50	6.25
Tue.	16	4.50	6.25
Wed.	17	4.50	6.25
Thu.	18	4.50	6.25
Fri.	19	4.50	6.25
Sat.	20	4.50	6.25
Sun.	21	4.50	6.25
Mon.	22	5.00	6.25
Tue.	23	5.00	6.25
Wed.	24	5.00	6.25
Thu.	25	5.00	6.25
Fri.	26	5.00	6.25
Sat.	27	5.00	6.25
Sun.	28	5.00	6.25
Mon.	29	5.05	6.15
Tue.	30	5.05	6.15
Wed.	31	5.05	6.15

TOTAL HOURS DURING 1906.

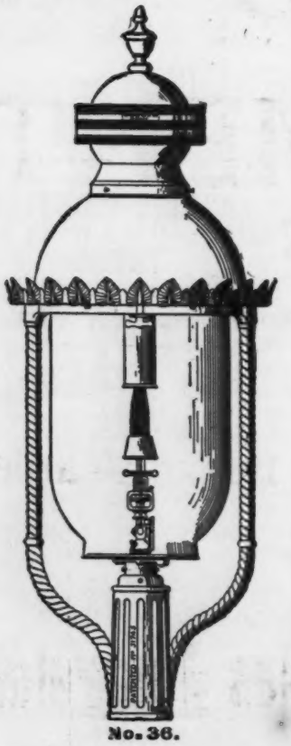
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 620 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

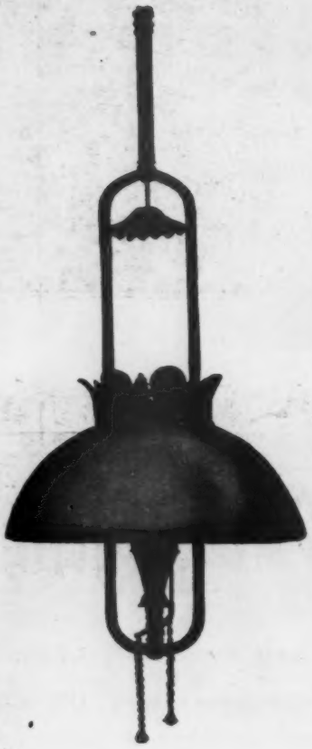
Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45 00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.



Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

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Salesrooms in all the principal cities of the United States.

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For the Period Ending July 1st, 1905, has been Awarded Contracts for 32 Sets of

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Pottsville, Pa. (2d contract).	**St. Louis, Mo.** (4th contract).	**Mahanoy City, Pa.**
Evansville, Ind. (2d contract).	**Sioux City, Ia.** (3d contract).	**Nanticoke, Pa.**

TOTAL SETS TO JULY 1ST, 1905, ... 585
TOTAL DAILY CAPACITY TO JULY 1ST, 1905, . 455,980,000 CU. FT.

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Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS.

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An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

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Modern Coal Gas Benches,

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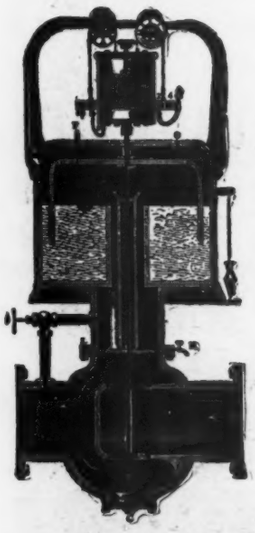

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For the Year 1904.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th Year of Publication.

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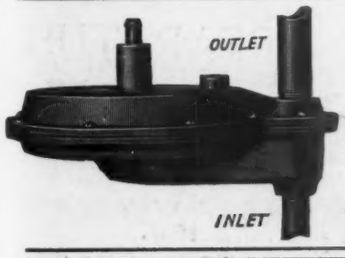

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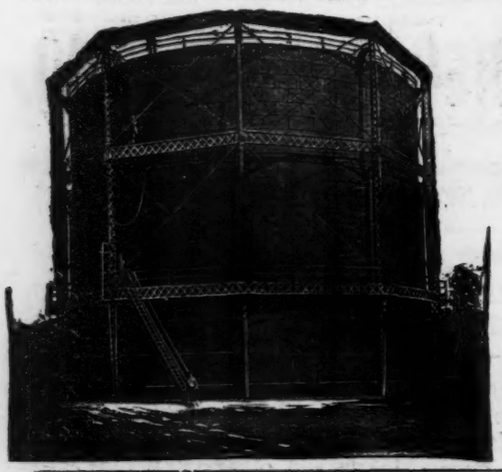

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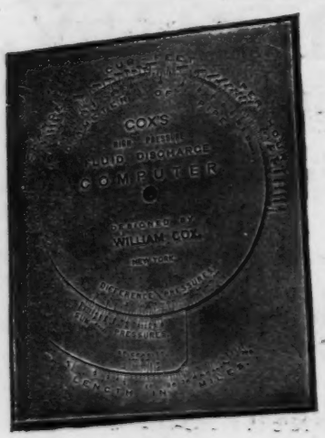

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Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
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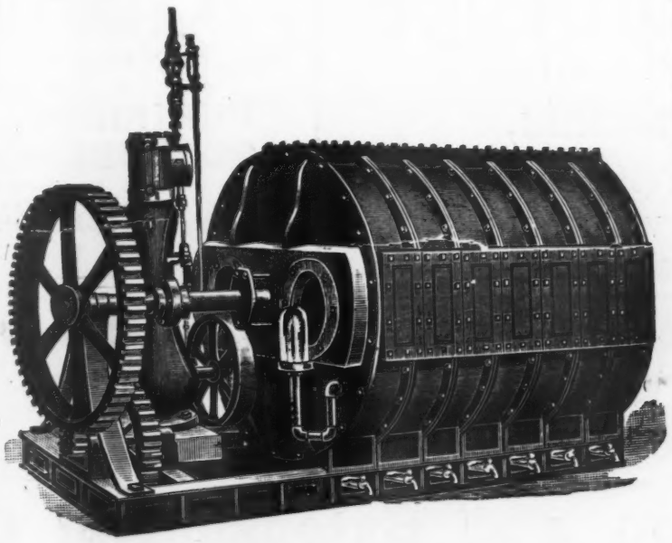

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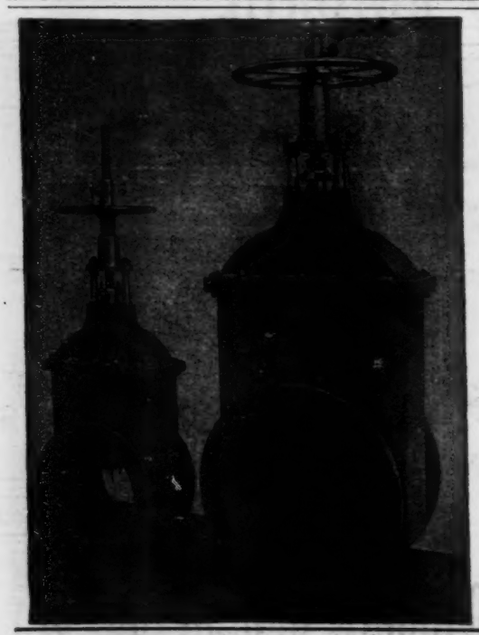

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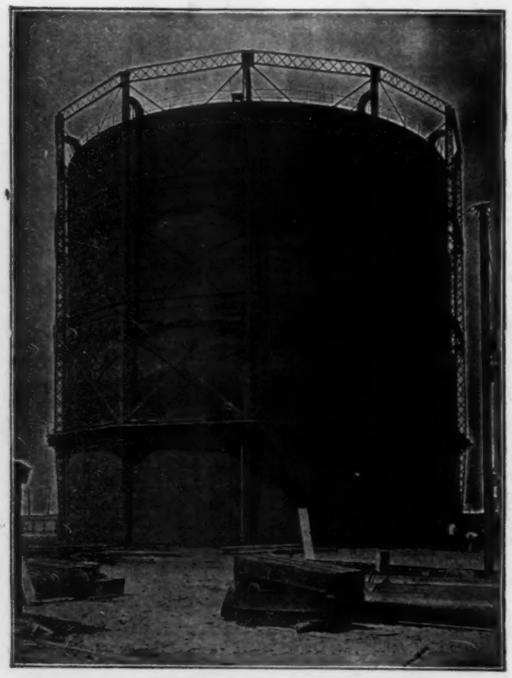

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